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FINAL REPORT

Contract No. FA67WA-1814
Project No. 560-004-06M

EXPERIMENTAL TRAINING PROGRAM UTILIZING AN INTEGRATED VFR-IFR CURRICULUM

AUGUST, 1968

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by

DEPARTMENT OF AVIATION
THE OHIO STATE UNIVERSITY
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August 1968

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ABSTRACT

A curriculum which combines the teaching of the private pilot flight skills with those necessary for full instrument privileges in the National Airspace System was designed and evaluated. The evaluation consisted of implementing the curriculum using an experimental group of zero time students and comparing their flight performances with those of two control groups. The private pilot control group and the instrument rating control group used the appropriate FAA approved school curriculum.

The integrated VFR-IFR curriculum called for 75 total flight hours in about 60 periods. A key feature of this curriculum was the introduction of all pertinent maneuvers using instrument references first and then followed by visual references. The relationships between the two sources of information were emphasized.

The experimental curriculum, although producing a superior private pilot, failed to develop the complex skills, judgment, and command ability necessary for the instrument rating. The experimental program did not allow for determining the relative effects of those variables which may have influenced the findings. However, it is believed that the lack of command ability can be correlated with insufficient exposure to "command" situations and decisions whether artifically created by the instructor or actually encountered on solo cross-country flights.

From the data obtained, an estimate of the time required for the experimental students to reach instrument rating standards cannot be made.

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INTRODUCTION

PURPOSE

An experimental flight training program was designed and carried out by The Department of Aviation, The Ohio State University, under the sponsorship of the Aircraft Development Service of the Federal Aviation Administration.

The purpose of this program was to develop and evaluate a curriculum which combines the teaching of the Private Pilot flight skills with those necessary for full instrument rating in the National Airspace System. The curriculum was to be used with student pilots having no previous flight training.

This report describes the experimentation program and presents the findings, conclusions, and recommendations.

BACKGROUND

Present pilot certification rules require that a private pilot applying for an instrument rating meet the aeronautical experience requirements for a commercial pilot certificate (FAR 61.35). One issue at hand is the validity of the aeronautical experience requirement. If the average pilot obtains his private license at 50 hours, does the additional minimum of 120 hours of unsupervised flight time influence his ability to obtain the instrument rating?

A second, and more important, issue concerns the psychology and techniques for combining contact and instrument training. A recent document on this subject by Smode, Hall, and Meyer (Ref. 19, pgs. 48-56) is an excellent survey.

The significant and pertinent results discussed in the survey can be briefly summarized here.

1. The traditional sequence of instrument training <u>after</u> contact training is suspect because it may

   a. develop habits which make instrument training more difficult;

   b. produce instrument pilots who lack confidence in instrument flying;

   c. prior to current standards, not prepare the novice private pilot with the basic instrument training to cope with an inadvertent instrument emergency; and

d. take longer for students to learn instrument flying than those with no previous flying experience.

2. Studies by Ritchie and Michael[14] indicate that

   a. contact flying is easier to learn than instrument flying,

   b. instrument flying is harder to learn after contact flying,

   c. instrument training first facilitates contact learning,

   d. total learning time for both contact and instrument tasks should be reduced when the instrument task is learned first, and

   e. the traditional order of contact then instruments allows the pilot to develop habits which make instrument instruction unnecessarily difficult.

3. Additional studies by Ritchie and Hanes[13] showed that results (a) and (c) above were verified but result (b) above was not verified, in that there was also positive transfer in going from contact to instrument; Ritchie and Hanes found no significant difference in total learning time.

4. Studies for the Navy by Creelman,[1,2,3] where instrument training was distributed throughout the flight syllabus rather than at the end, generally resulted in no significant effects.

5. A study at the University of Illinois[23] set out to teach positive control of the aircraft on instruments in the 40 hour private pilot course. This was successfully accomplished by devoting the first 5 periods (3.2 hours) to instruments and then interspersing instrument training throughout the course where possible.

6. In studies at West Virginia University[15,16] similar results were reported under similar conditions. However, the first study continued two of the ten students through a 20 hour instrument curriculum with excellent success. One student was able to meet the instrument rating standards and the other required "only a few more hours" to meet instrument rating standards.

7. An unpublished Army Aviation study by W. Prophet (HumRRO, 1963) showed that instrument training early in the primary program resulted in better scores and fewer dropouts for students at the 30 hour check point than for those in the control group. These differences in performance tended to disappear after approximately 200 hours of flight experience.

8. Another unpublished Air Force study at Graham AFB in 1956-1957 reported that differences between integrated primary training groups and control groups were small but in favor of the integrated groups. Conclusions were not definite because of the presence of uncontrolled variables.

9. A very small (eight students) study by the Army Aviation School at Fort Rucker, was conducted in 1956-1957 to determine the feasibility of using integrated concepts. The normal course length for both contact and instrument training was shortened by nine weeks and 48 flight hours using the integrated concepts with five of the pilots receiving instrument qualification.

Two concise paragraphs from Smode, Hall and Meyer[19] (pg. 53,54) are reproduced here to define and distinguish the meaning of integrated training in its two predominant forms.

> In the integrated studies described in the foregoing, the student first learns to perform a maneuver by use of either contact or instrument cues (but not both) and then relearns it by use of the other set of cues. This type of training has been called the "block" training. True integrated training involves the simultaneous presentation to the student of both contact and instrument cues while he is learning a maneuver. During this type of training (i.e., "simultaneous cue" method), the instructor systematically demonstrated to the student how the instrument and contact cues relate to each other.
>
> The efficacy of this method stems from the observation that that the experienced pilot flies his aircraft in an integrated fashion by use of cues from either or both visual sources alternately, simultaneously, or combinationally. Thus he controls the aircraft by means of a single integrated flying techniques rather than by instrument or contact flying techniques (Poe, Jolly, & Prophet, 1960)[12]. This integrated training concept seeks to teach the pilot the "single technique" of aircraft attitude control rather than waiting for him to develop it on his own.

In summarizing the past research efforts, it is apparent that the value of combined contact-instrument training was not clearly determined. In each of these studies, the assumptions, conditions, and variables were different in some respect. The resultant findings prevented generalization.

Some of the experimental problems can be attributed to insufficient detail of experimental design, procedural problems, and experimental control. The conditions or experimental tasks have, in many of the studies, been simplified. For example, some of the studies aimed only for positive aircraft control on instruments, other studies for full instrument competency in the ATC system at that time. The navigational aids and airborne instrumentation have undergone considerable improvement in the past decade. The syllabus for teaching and the quality of instructors may have had an effect on the outcome. Thus, the single greatest problem with all of these studies is that each of these variables could not be independently measured. Although the concept of combined contact-instrument training is comparatively simple, the evaluation of the concept is confoundingly difficult.

The present study is indicative of the interest by the Federal Aviation Administration to review carefully the integrated training concepts in light of current technologies, conditions, and methodologies.

FAA GUIDELINES

The experimental program was structured to comply with the following major guidelines as provided by the FAA:

1. Select, as an experimental group, 15 students for training under the developed VFR-IFR curriculum.

2. Thirty students shall be selected to make up two control groups; one group of 15 from those students enrolled in the approved school private pilot curriculum, and one group of 15 students selected from those undergoing training in the approved school instrument curriculum.

3. The performance of students in the experimental group shall be compared to performances of students in the control groups.

OBJECTIVES

The objectives for the experimentation program have been derived through interpretation of the interests of the Federal Aviation Administration. In general, under the following set of objectives, an attempt was made to obtain extensive and meaningful data to guide further standards for pilot and school certification:

1. To develop a training curriculum for the simultaneous training of contact and instrument flying for general aviation pilots with the intention of satisfying both the private pilot and instrument rating competency requirements.

2. The development of such a curriculum will encompass the latest known principles in training research and to evaluate the effectiveness of these principles.

3. To consider the practicality of the new curriculum in the light of present training facilities and methods.

4. To provide data and experiences that will lead to more efficient and effective curricula in the simultaneous training of contact and instrument flying skills.

5. To determine the potential advantages or disadvantages of a combined VFR-IFR curriculum when compared to present sequential methods of training pilots.

6. To determine and assess those aspects of pilot training which lead directly to the development of judgment and maturity in the pilot.

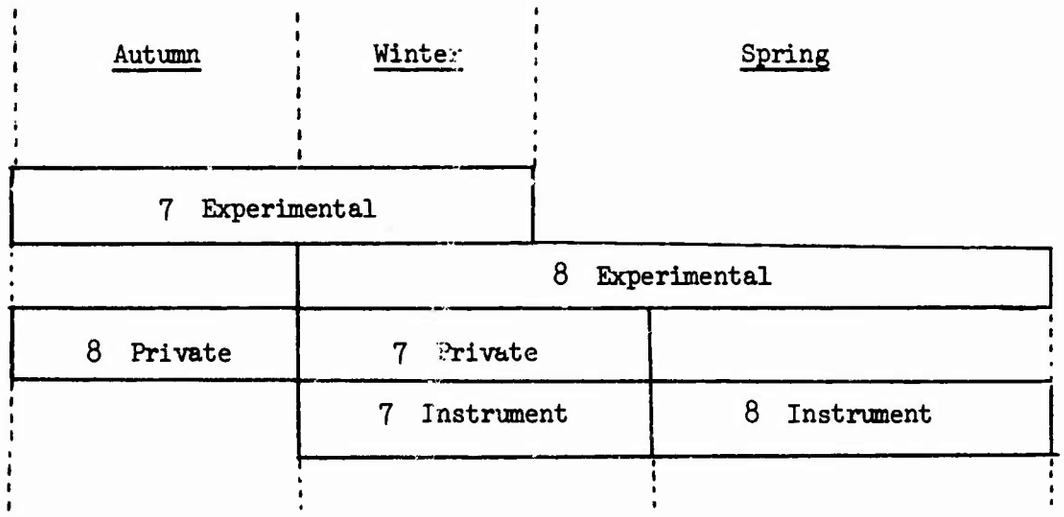
7. To attempt to assess the relationship of ground school instruction to flight instruction.

8. To obtain data so as to evaluate previous experimentation programs in related pilot training.

THE EXPERIMENTAL PLAN

The experimental program was carried out during the three academic quarters of the 1967-1968 academic year (October 1967 through June 1968). Three groups of 15 male students each were selected as subjects for the program. The groups were identified as Group E for the experimental group, Group P for the private pilot control group, and Group C for the instrument pilot control group. The experimental students each required two academic quarters of training. A student in each of the control groups required only one academic quarter.

Inasmuch as the groups could not be run at the same time because of scheduling and aircraft availability, the groups were partitioned as shown in the following table.



Group P (Private) students followed the standard syllabus for the Department's approved primary flight school (Appendix C). Group C (Instrument) students were trained in accordance with the approved syllabus of the instrument school (Appendix D).

The experimental syllabus was designed to cover approximately 75 hours of flight instruction in 60 periods of flight. All private pilot aeronautical experience requirements were provided for, as well as all instrument pilot requirements, with the obvious exception of the total flight time requirements. In addition, a series of instructor guidelines was prepared to provide a measure of control and uniformity in the teaching of flight skills by the integrated method. The full syllabus and accompanying instructor guidelines are presented in Appendix B.

STUDENT SELECTION

A selective choice of students for the experimental group was not possible because of the financial burden of 75 hours flight time and because only the private license could reasonable be expected. Whenever possible, students in the private pilot course were selected to match the experimental students.

INSTRUCTOR QUALIFICATIONS

Five instrument instructors were utilized in this program. A summary of the flight instructors' qualifications is presented in Table I. The instructors were assigned students in the Experimental group and were briefed in a meeting conducted by the project supervisors well in

TABLE I

Summary - Flight Instructor Qualifications

	FI_1	FI_2	FI_3	FI_4	FI_5
Age	29	23	20	23	22
Total Flight Hours	2800	1200	1000	1675	1050
Total Instructional Hours	2300	800	525	1153	550
Instrument Instruction Given	650	350	150	378	130
Pilot Licenses					
ATR	X				
Commercial-Airplane, Land	X	X	X	X	X
Single Engine	X	X	X	X	X
Multi Engine	X	X	X	X	X
Instruments	X	X	X	X	X
Flight Instructor					
Airplane and Instruments	X	X	X	X	X
Ground Instructor					
Basic	X	X		X	X
Advanced	X	X		X	X
Instruments	X	X		X	X
Marital Status	M	S	S	M	S
Male or Female	M	F	M	M	M
Educational Degrees	MBA	BA Educ	Student (Educ)	BS Educ	Student (Educ)

advance of the beginning of flight training. Several meetings were held during the course of the experiment to resolve problems as they arose. It is a practice of the Department to hold biweekly instructor meetings in any case, so this provided still another method of control of the program.

FLIGHT CHECKS AND DATA COLLECTION

Flight checks were conducted on all students according to the following schedule:

Experimental Group (E)

Stage I	10 hours	
Stage II	30 hours	
Stage III	50 hours	
Stage IV	60 hours	(Private Pilot Check Ride)
Stage V	75 hours	(Instrument Evaluation Check Ride)

Private Pilot Control Group (P)

Stage I	9.5 hours	
Stage II	20 hours	
Stage IV	35-40 hours	(Private Pilot Check Ride)

Instrument Pilot Control Group (C)

Stage I	10 hours	
Stage II	20 hours	
Stage III	30 hours	
Stage IV	35-40 hours	(Final Instrument Check Ride)

The flight profiles for each of the stage checks are described in Appendix F. Final flight checks for the private pilot control group and the instrument control group were given by a faculty member who is both a designated instrument examiner and an ATR pilot. With the exception of the final instrument evaluation, all the stage checks for the experimental group were conducted by the school examiners. Of the 15 final instrument flight evaluations, 12 were done by Mr. Fred Martin, from the Columbus General Aviation District Office; 2 by Mr. Russ Maynard, from the Flight Standards Service, FAA Washington Office; and 1 by the school's designated examiner when Mr. Martin was unavailable.

Data on all flight checks were obtained through the use of the Pilot Performance Description Records (PPDR). A sample set appears in Appendix G. Other data collected consisted of questionnaires completed by both students and instructors. The FAA personnel submitted detailed narratives of those flight evaluations they conducted.

AIRCRAFT AND EQUIPMENT USED

The students in both the experimental and instrument control groups were assigned to one of three instrument trainers.

N180SU (PA-28-140)
- Dual 360-channel communications transceivers
- Dual navigation receivers
- Dual VOR/localizer indicators
- Single glide slope receiver and indicator
- ADF receiver
- Marker beacon receiver
- 4096 code transponder

N210SU (PA-28-140)
- Same as for N180SU but without transponder

N8371R (PA-28-150)
- Single 360-channel communications transceivers
- Single navigation receiver
- Single VOR/localizer indicator
- ADF receiver
- Marker beacon receiver

METHOD

The greatest efforts in the experimentation program, with its stated objectives, were directed to four significant and technically difficult areas.

1. Definition and development of an integrated VFR-IFR curriculum.
2. Pedagogical techniques and aids to implement the curriculum.
3. Criteria and techniques for measuring pilot performance.
4. Establishing valid and unambiguous comparisons between the experimental and control groups.

This section of the report will discuss these efforts in the above order. However, it is necessary to discuss first the guidelines that were adopted in order to confine the efforts to manageable proportions.

GUIDELINES

1. In view of the many concepts of integrated contact and instrument training, it was felt that the initial curriculum should remain flexible in order to accommodate new ideas and techniques. Although the flexibility may affect the comparisons between the groups, it was felt that negative trends should be corrected immediately.

2. The techniques and teaching aids should not be so sophisticated as to preclude repetition of the program by other equally good schools and fixed-base operations. For example, the use of highly effective, but expensive, ground trainers was not attempted.

3. Acknowledge and document the role that the average flight instructor plays in the progress of his student; such standardization of the flight instructors for experimental programs requires a degree of orientation not easily achieved.

4. Accept the possibility that the teaching of instrument skills in the pre-solo phase would delay the time to solo and to private pilot certification.

THE EXPERIMENTAL CURRICULUM

The development of an integrated VFR-IFR curriculum by The Ohio State University Department of Aviation required a reasonable definition of what is meant by integrated VFR-IFR training. As discussed earlier, integration could be applied in several ways; i.e., "block" training versus "simultaneous cue" methods. The block concept of learning a maneuver by instruments or contact cues, but not both, and then relearning the maneuver by the use of the other set of cues, appeared to have more advantages than the teaching of both set of cues simultaneously. It was felt that the instrument cues were more precise and responsive to control actions than the visual cues. It was also recognized that the processing of the separate sources of information from the instruments was more difficult than the composite information received from the external visual references. On the other hand, it was felt that the teaching of the logical procedures to be used in processing the multi-instrument information would be easier than teaching from visual references that were often indistinct and, even under the best conditions, literally difficult to describe. Furthermore since the full instrument capability was desired in the long run, introduction of these skills appropriately early should lead to more automatic response behavior when the associated IFR procedural tasks were added.

Thus, block training was attempted, with the maneuvers being learned first with instruments and then with visual references.* However, it was

*This concept of block training was first tried by the Army Aviation School at Ft. Rucker in 1956 and shown to be worthy of further testing.

often reported that after the above sequence for any maneuver, the instructor then attempted to relate the two sources of information simultaneously. This had the dual effect of verifying one set of cues against the other set, and instilling confidence in both sets of cues.

The initial syllabus was thus heavily oriented toward the demonstrations and practice of each new, but appropriate, maneuver, using first the instrument cues. Those maneuvers which obviously require ground references for their performance were not done on instruments, but by that time in the program, the simultaneous use of the appropriate instruments was cultivated. In some cases, the transfer to visual cues was negative; the student could not or would not use the visual cues.*

The experimental syllabus as first developed also attempted to use the Link C-8 ground trainer for the first three hours of the program. The first one to two hours were conducted with the cockpit canopy removed. A horizontal line was taped on the walls surrounding the trainer at such a level as to fairly represent the horizon. The objectives in these initial hours was to develop instrument interpretation, basic control responses, and altitude transitions.

With the cockpit canopy removed the student appeared to learn easily how to interpret the instruments. The effect of the outside visual references (ceiling, walls, etc.), whether through his peripheral vision or otherwise, served to strongly interact with his instrument interpretation. The student thought he was using only the instruments, but actually he was using the outside references in some "simultaneous" manner. This interaction between the two sources became apparent when the cockpit canopy was closed. The student experienced considerable difficulty in processing the instrument information.

The mechanism by which a pilot processes the visual cues is not well understood and remains a complex subject. Using the Link with the cockpit cover off as an example, the student was shown how easy it is to obtain information unknowingly from the outside, or contact, references. It was emphasized that in the absence of contact cues, the same information, a logical and understanding procedure has to be developed. For example, the directional gyro does not indicate how to control the airplane; it is used as a "decision" instrument. That is, it tells the pilot whether his heading is correct or not, and if not correct, the magnitude and direction of the heading error. The pilot should then go to another instrument, the artificial horizon, to establish the correcting maneuver.

It was intended that the initial Link exposure continue until achievement of reasonable mechanical behavior to perform altitude transitions. But here the instability of these old-time trainers created more problems

* One incident occurred where the student actually ignored the visual references in the landing pattern and would have descended into the ground on base leg.

than it cured. The Link C-8 was very difficult to trim for a "hands-off" condition. It was decided that the inherent stability of the real aircraft could now be appreciated by the student and initial training in the Link stopped after three hours, regardless of the students' progress.

In subsequent uses of the Link C-8, training was limited to developing the navigation and communication capabilities. In many cases this was effectively accomplished by locking the pitch and roll axes.

The experimental curriculum was designed to introduce IFR procedures and planning at a very early stage. It was intended that home preparation for each flight be as extensive as possible considering the students' other study commitments. Early planning of the exposure and experiences to the National Airspace System was considered necessary for the development of the students maturity and judgment. It is this area of maturity and judgment that will be the subject of considerable discussion later in this report.

Because the student pilot had to learn to land the airplane, the curriculum emphasis on visual references increased considerably after the first five or six hours until solo. An attempt was made to still use an IFR departure with clearances for the first takeoff of each period, cancel when established on the nearest airway, and return to the airport VFR for concentrated landing practice.

The achievement of first solo and solo practice became a serious issue. Student motivation and confidence tended to deteriorate after prolonged dual to first solo. The need to relax and enjoy the scenery became a necessary respite from the forced instructional pace. The self-confidence to be gained from solo X-C was also underestimated by the experimental curriculum. On the other hand, no instructor feared that his student would ever get lost when solo.

Thus, the VFR-IFR curriculum that was developed and modified throughout the experiment attempted to apply both the block and simultaneous methods of integrating contact and instrument training. And, because of the complexity in IFR procedures and knowledge requirements, ground school, ground trainers, and audio-visual aids were all used in an attempt to prepare the student.

Integration of class scheduling with flight training followed traditional methods. As could be expected classroom and flight activities were not always in perfect coordination because individual students rate of progress varied or weather altered the planned flight schedule.

IMPLEMENTING THE EXPERIMENTAL CURRICULUM

The greatest concern in the implementation of the experimental curriculum was in being able to monitor instructor and student performance. Specialized record keeping was attempted which would measure the student's daily progress until it was realized that the paperwork required of the instructors interfered with their instruction. Accepting the loss of data in favor of better instructor attitudes, an alternative system of meeting with the individual instructor once each week was established. During these meetings the instructor reviewed the student's progress and enabled the principal investigators to record the number of periods of exposure on the various curriculum elements. Special student or instructor problems were discussed and changes made so as to accomplish the program's end objectives.

Once every two weeks during the program, the instructors would meet as a group to discuss special educational techniques. Emphasis was placed on three concepts: intellectualization by the student, positive feedback to the student, and development of the student's independence from the instructor.

Intellectualization required that the student verbalize to the instructor before the flight exactly how he was going to conduct the flight. The student had to indicate his knowledge of such details as expected communications, tuning of radios, what headings to turn to and when, etc. The student's description was to remain in the same chronological order as his expected flight. The ability of the student to time-share his activities was considered to be strongly related to his preparation and degree of anticipation.

Positive feedback to the student on his performance is essential. The highest degree of feedback could be accomplished through the use of video and audio tape recordings of the student's performance. A brief attempt at video recording of the instruments in flight proved to be both costly and technically difficult. Audio tape recording was tried with more, but still inadequate, success. However, an outcome of this latter attempt brought forth specific requirements for the development of a two-channel tape recorder. One channel would record all air-ground communications; the second channel would permit instructor comments without being heard by the student. This specialized tape recorder is now being constructed and should shortly be available for testing.

The remaining and more traditional technique of providing feedback of the student's performance was the use of detailed notes by the instructor and the use of these notes in a thorough post-flight discussion with the student.

The other major concept in implementing the experimental curriculum was the need to develop the student's self confidence and independence

from his instructor. The potential complexity of the National Airspace System requires that the instrument-rated pilot be able to make and carry out correct decisions in the event of route changes, emergencies, changing weather factors, and traffic congestion. Special instructional techniques are required which are often functions of the natures of both the instructor and student. However, some general suggestions were made regarding the instructor-student relationship, the creation of situations which stress the student, and the creation of problems and attitudes which allow the student to become critical of his instructor. The experience and wisdom of the instructor had considerable influence on the development of the student's judgment and independence.

Another aspect of the program that was encouraged was to have the student file and fly in actual weather with his instructor. The value of these experiences is well known and requires no discussion.

MEASURING PILOT PERFORMANCE

The effectiveness of the experimental curriculum was determined by the program's ability to measure pilot performance. As in all previous studies of pilot training, this single factor of measuring pilot proficiency has caused more concern and effort than any other factor. Until that future day when an aircraft can be instrumented in a noninterfering way and have the capability to automatically record or telemeter all relevant flight and pilot characteristics we shall continue to introduce subjective elements into the evaluation.

Pilot performance was measured through the use of flight checks and Pilot Performance Description Records (PPDR).* The underlying concept of the PPDR is that the check pilot consistently follows a well-defined procedure and uses a scoring system which attempts to describe what the student pilot did. For example, the maneuvers are broken down into segments, each segment being characterized by a set of important parameters; i.e., airspeed, pitch and bank attitudes, altitude, and heading (or track). Scales have been developed for each parameter, allowing the check pilot to quickly indicate an approximate or exact value for the parameter. Deviations from the desired values form a quantitative basis of measurement of the student's skill. Of course there are some maneuvers or aspects of the private pilot standards for which objective scores and not feasible, such as judgment, emergency planning, coordination, technique, communications, etc. In these cases, scales can still be used but they are highly subjective.

The scoring of the PPDR was based on a set of standards developed by the senior staff. Each item on the PPDR had an error value, with the desired performance scored as zero error. The total scores for each

*The concept of the Pilot Performance Description Records was developed by the Human Resources Research Office (HumRRO) at Fort Rucker, Alabama, in the evaluation of Army helicopter pilot training.

maneuver reflected the deviations from standard; the lower the error score the better the performance.

COMPARABILITY

As directed by the FAA guidelines, the experimental group was to be compared against a private pilot control group and an instrument pilot control group, each group consisting of at least 15 students. The comparisons should focus on the relative effectiveness of the experimental VFR-IFR curriculum. It was therefore necessary to establish the time points within each group for comparisons, using the control groups as references.

The available flight comparisons between the experimental group and private pilot group were the Stage I, Stage II, and private pilot certification ride.* Of these three comparisons, only the first two were comparable in terms of accumulated flying time. The private pilot certification flight check for the private pilot control group occurred at about 40 hours, whereas the experimental group took their certification flight checks between 60 and 80 hours. In each of these three flight checks the error scores were based on VFR maneuvers.

There were four flight comparisons between the experimental group and the instrument control group. The items in this set of comparisons were all based on the average error score for only the IFR maneuvers. It would be appropriate at this point to discuss the validity of these comparisons by examining the possible sources of bias and confounding that can arise in pilot training studies. Bias can be present whenever the comparisons contain a potentially relevant factor in favor of one of the groups; e.g., uneven proportion of instrument time, or one group having obviously more experienced instructors than the other group. Confounding is similar to bias except that one does not know which variable is the source of the difference.

In the comparisons between the experimental group and the private pilot control group, one must assess the effect of the added 20-40 hours accumulated by the experimental group when those students took their private pilot certification flight check. This difference in total flight time can be a meaningful bias in favor of the experimental group.

When comparing the experimental group and the instrument control group, the problem of confounding appears. Two variables present in these two groups were significant in the sense that they were likely to affect the results, but there was no way of knowing the direction of their effects; i.e., which way did they affect the results. These two variables were the experimental curriculum for the experimental group, and the total flight time experience requirement for the instrument group.

*See Page 8 for the schedule of the various flight checks.

Thus, if the instrument control group is better than the experimental group, the following explanations are possible:

1. The flight time experience requirement is the cause for the difference, or

2. the experimental curriculum was poorly designed and/or carried out, or

3. the standard instrument curriculum is far superior to both the experimental curriculum and independent of the flight time requirement.

Similarly, one could easily develop sets of alternative explanations if the experimental group was better than the control group, or if the two groups were equal.

The difficulty with this type of confounding is the inevitability of subjectively assigning weights to the alternative explanations. The result is accepting the explanation receiving the greatest weight.

This problem of confounding in the experimental design was discussed at length in the proposal for this study. An alternate design was submitted, but rejected.*

STATISTICAL ANALYSES

The comparisons between the experimental and the control groups were primarily based on determining the statistical significance of the differences in their mean error scores. For each flight check the PPDR was scored for the maneuvers and capabilities being tested. Three basic sets of calculations (listed below) were computed for each group for each flight check.

1. Mean error score and standard deviation for each student when averaged over the maneuvers.

2. Mean error score and standard deviation for each maneuver when averaged over the students.

3. An overall, or grand, mean error score averaged over all students and maneuvers in the group.

*If the primary objective was to evaluate curricula, the recommended experimental design called for the private pilot control group taking the standard instrument course in immediate sequence, thus eliminating the effect of the flight time experience requirement.

Comparisons between individual students were not considered, other than to call attention to the good or bad performances. Comparisons between the groups were based primarily on the mean error scores by maneuvers, and the overall mean error score. The most meaningful statistical test used was the modified t statistic and the standard single tail t probability distribution.* The modified t statistic was used because of the unequal sample sizes and, more importantly, unequal standard deviations.

A multi-level analysis of variance was conducted and, in general, it supported the above t statistic tests. The validity of the analysis of variance was, however, weakened by the unequal variances and, in some cases, the need to drop students to form equal group sizes.

Significance levels were tabulated for each computed t value. Only those significance levels below 0.10 are to be considered significant.

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*See Bowker and Leiberman, Engineering Statistics, page 173.

RESULTS

SIGNIFICANT RESULTS

1. The experimental group was considerably better than the private pilot control group at the time of their private pilot certifications.

2. The instrument pilot control group was considerably better than the experimental group at the time of their final instrument evaluations. Specifically, in the instrument control group.

   a. nine instrument ratings were issued after an average of 36 dual flight hours, and

   b. two are continuing, with both expected to pass within 45 dual flight hours.

In the experimental group

   a. only one student was able to meet the standards for the instrument rating after a total flight time of 80 hours,

   b. twelve students were unable to pass the final instrument evaluation after an average of 76 hours total flight time, and

   c. two of the above twelve were given further instrument instruction of 20 hours and 30 hours and when retested were still unsatisfactory.

STUDENT CHARACTERISTICS

The pertinent background characteristics of all flight students are presented in Tables II-IV. The age and occupational distribution within the experimental group and the instrument control group are considered to be representative of those in a population who appreciate or desire the instrument rating capability. The private pilot control group is, on the other hand, not too representative of the primary pilot population, since all were college students. The flight students in all groups were male.

All students attended the ground school courses associated with their flight programs. Performance on the FAA Private Pilot written examination showed no differences to suggest a bias from either the different ground school courses or in their academic abilities.

TABLE II

Student Background Characteristics
Experimental Group

Student	Occupation	Age	FAA Private Written Score
E1	Surgeon	44	95
E2	Student (Bio Sc.)	23	90
E3	Student (Arts)	25	93
E4	Grad Student	30	86
E5	Student (Arts)	21	86
E6	Student (Arts)	27	73
E7	Student (Commerce)	20	73
E8	Student (Commerce	23	none
E9	Student (Commerce)	21	80
E10	Laborer	25	65
E11	Student (Commerce)	20	93
E12	Student (Commerce)	20	78
E13	Teaching Associate	27	75
E14	Airline Ticket Agent	23	73
E15	Professor PHD	39	88
E16	Student & Laborer	24	93
Mean		25.75	82.7
N		16	15

TABLE III

Student Background Characteristics
Private Pilot Control Group

Student	Occupation	Age	FAA Private Written Score
P1	Student (Agriculture)	19	83
P2	Student (Eng.) AFROTC	21	75
P3	Student (Arts) AROTC	22	82
P4	Student (Arts) AFROTC	23	95
P5	Student (Grad)	23	86
P6	Student (Engineering)	22	90
P7	Student (Arts & Sc.) AROTC	22	75
P8	Student (Arts) AROTC	22	none
P9	Student (Arts) NROTC	21	83
P10	Student (Ec.) AROTC	22	85
P11	Student (Ec.) AROTC	22	69
P12	Student (Eng.) NROTC	23	73
P13	USAF Lt. (Eng.)	24	93
P14	FAA ATC	34	98
P15	Student AFROTC	24	70
Mean		22.9	82.6
N		15	14

TABLE IV

Student Background Characteristics
Instrument Control Group

Student	Occupation	Age	FAA Instrument Written Score	Certificate Held at Start
C1	Businessman	37	76	Private
C2	Student (Arts)	22	82	Commercial
C3	Lawyer	39	84	Private
C4	Student (part time)	24	72	Commercial
C5	Laborer	30	none	Private
C6	Professor	47	68	Private
C7	Grad Student	28	84	Private
C8	Businessman	33	74	Commercial
C9	Student (Commerce)	19	76	Commercial
C10	Teacher	38	68	Private
C11	Engineer PHD	39	72	Private
C12	Professor PHD	38	84	Private
C13	Physician	43	76	Private
C14	Student (Commerce)	21	90	Commercial
C15	Student (Commerce)	20	72	Commercial
Mean		31.9	75.9	
N		15	14	

FLIGHT TIME MEASURES

In the experimental curriculum, mean time to solo (16 hours) was expected to be greater than the control group (10 hours) in view of the added instructional items within the pre-solo phase. In the same vein, total time to private pilot certification was planned to be greater for the experimental group. However, a change was made in the experimental group; i.e., half the group took the private pilot certification before the final instrument evaluation (69 hours) and half took their certification ride after the instrument evaluation (79 hours).

FLIGHT CHECK ERROR SCORE

The basic method for comparing the experimental group and the control groups was the use of flight checks and their scoring via the Pilot Performance Description Records (PPDR). Although some of the flight checks for the experimental group and the private pilot control group contained both VFR and IFR maneuvers, the following tabulated comparisons were based on either the VFR performance or IFR performance, but not both. It is also important to note that the flight checks of the instrument control group included no scoring of any VFR performance.

Tables VIII-XXI present the error scores for each student for each maneuver. These tables can be summarized by averaging the student's error score over all the maneuvers for each flight check, as shown in Tables XXII-XXIV. In these last three tables, one can easily see the distribution of "good" and "bad" students.

The significance of these latter three tables appears when one studies the grand mean error score for each flight check and its associated standard deviation. First, it is these grand mean error scores that will be used to compare group performance. Second, the trend of these grand mean error scores as the group progresses through the curriculum must be considered.

A better appreciation of the group comparisons will be gained if the trends are presented first.

First, a note of caution: The mean error scores that are plotted represent the group's average performance for all maneuvers on the flight check. However, the same flight check number (i.e., Stage I, II, or III) did not contain the same complete set of maneuvers for each group. For example, Stage I (IFR) for Group E had only 1 out of 13 maneuvers in common with Group C. On the Stage II (IFR) check, Group E had 6 maneuvers in common. Thus, these figures are not to be used for group comparison, but for describing each groups performance.

TABLE V

Flight Time Measures
Experimental Group

Student	Instructor	Time to Solo	Time to Private Flight Check		Time to Final Instrument Evaluation	Actual Instrument Time
			Before Final Instrument	After		
E1	FI1	19.3	71.1		78.2	1.9
E2	FI1, FI2	33.5		80.6	79.1	.5
E3	FI2	19.2		80.0	75.2	1.2
E4	FI4	15.9		76.3	73.0	1.3
E5	FI1	13.2	68.5		78.0	2.5
E6	FI3	12.7		73.0	71.4	3.6
E7	FI5	8.1	68.3		71.6	2.7
E8	FI3	12.9				
E9	FI5	12.8	68.9		89.8	1.5
E10	FI1, FI2	21.4				.9
E11	FI1	11.2	67.8		79.9	1.3
E12	FI2	16.0	68.0		72.0	2.3
E13	FI4	17.7				.4
E14	FI2	11.3		81.7	72.9	3.2
E15	FI1, FI3	15.9	66.9		70.7	2.3
E16		11.9		81.4	74.8	2.4
Mean		15.8	68.5	78.8	75.8	1.9
N		16	7	6	13	15

TABLE VI

Flight Time Measures
Private Pilot Control Group

Student	Time to Solo	Total Time to Private Flight Check	Total Basic Instrument Time
P1	12.0	49.0	3.5
P2	10.0	46.8	2.0
P3	9.0	35.7	3.0
P4	8.4	36.5	3.4
P5	9.3	37.5	3.1
P6	13.9	36.4	2.9
P7	10.5	39.5	2.5
P8	10.5	35.7	2.0
P9	12.0	42.0	3.3
P10	9.4	35.9	2.3
P11	9.2	35.5	3.0
P12	8.1	36.3	3.3
P13	10.8	39.0	3.4
P14	12.0	47.3	3.8
P15	10.5	46.5	3.0
Mean	10.4	39.6	2.9
N	15	15	15

TABLE VII

Flight Time Measures
Instrument Control Group

Student	Instructor	Total Flight Time at Start	Instrument Dual Received	Actual Instrument Time	Passed
C1	Extra	175	38.5	3.1	Continuing
C2	FI4	210	35.6	1.8	Yes
C3	Extra	450	35.0	4.5	Yes
C4	FI2	200	35.0	2.0	Yes
C5	FI1	400	32.5	-	No
C6	Extra	250	37.	2.8	No
C7	FI3	200	46.3	3.5	Yes
C8	FI5	1500	35.0	0	Yes
C9	FI5	200	35.0	0	Yes
C10	FI2	250	36.4	2.5	Continuing
C11	FI1	375	35.0	2.2	Yes
C12	FI1	500	38.0	2.0	No
C13	FI2	375	35.0	2.8	Yes
C14	FI4	200	35.0	.5	Yes
C15	FI5	225	35.0	0	Yes
Mean		367	36.3	2.0	
N.		15	15	14 14	

TABLE VIII

Flight Check Error Scores
Stage I Experimental Group VFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns (VFR)	Altitude Transitions VFR	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Emergencies	Steep Turns (VFR)	Mean	S.D.
E1	0	0	5	0	0	0	11	6	6	3	6	3.36	3.72
E2	0	1	1	3	2	7	9	9	12	10	4	5.27	4.24
E3	0	0	9	8	5	13	12	6	14	1	30	8.90	8.61
E4	0	4	8	2	0	1	8	2	6	12	8	4.63	4.00
E5	0	1	3	4	3	1	5	0	2	0	0	1.72	1.79
E6	0	0	8	3	3	5	2	12	9	9	26	7.00	7.44
E7	0	1	5	1	5	4	6	6	1	0	0	2.63	2.54
E8	0	4	5	3	4	4	15	2	6	11	1	5.00	4.40
E9	2	4	6	5	7	6	16	13	10	3	6	7.09	4.27
E10	0	4	2	1	0	6	12	6	9	0	33	6.63	9.60
E11	0	1	10	1	0	0	11	6	3	3	3	3.45	3.93
E12	0	2	7	5	4	8	12	5	6	1	5	5.00	3.37
E13	0	2	10	20	7	14	17	12	10	11	10	10.20	2.84
E14	0	3	5	1	0	0	8	8	11	9	22	6.09	6.64
E15	0	0	6	3	4	9	2	9	10	9	5	5.18	3.70
E16	0	1	7	7	5	7	5	13	13	14	20	8.36	6.02

TABLE IX

Flight Check Error Scores
Stage I Private Pilot Group VFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Emergencies	Normal Landing	Mean	S.D.
P1	0	0	2	0	4	5	11	2	5	1	3.00	3.43
P2	0	4	7	2	4	7	8	7	12	7	5.80	3.39
P3	0	0	7	2	6	7	5	6	6	2	4.10	2.80
P4	0	0	5	3	8	8	9	4	3	1	4.10	3.34
P5	0	2	3	6	5	14	11	7	4	4	5.60	4.19
P6	0	1	5	4	8	6	9	9	7	2	5.10	3.28
P7	2	5	10	2	5	21	7	6	6	3	6.70	5.57
P8	0	1	11	2	8	19	13	11	11	7	11.30	11.99
P9	0	0	4	2	9	5	12	7	6	5	5.00	3.80
P10	0	2	1	1	11	13	9	6	7	4	5.40	4.55
P11	0	0	9	2	9	6	4	5	3	0	3.80	3.45
P12	0	0	3	4	10	11	7	10	3	7	5.50	4.08
P13	0	1	4	0	4	2	5	5	4	8	3.30	2.54
P14	0	0	1	2	5	6	2	3	7	4	3.00	2.44
P15	0	4	12	9	14	30	18	8	7	1	10.30	8.90

TABLE X

Flight Check Error Scores
Stage I Experimental Group IFR Maneuvers

	Straight & Level & Turns	Altitude Transitions (IFR)	Mean	S.D.
E1	1	3	2.00	1.41
E2	6	5	5.50	0.70
E3	0	8	4.00	5.65
E4	4	2	3.00	1.41
E5	4	6	5.00	1.41
E6	4	12	8.00	5.65
E7	4	6	5.00	1.41
E8	3	6	4.50	2.12
E9	2	7	4.50	3.53
E10	5	10	7.50	3.53
E11	1	0	0.50	0.70
E12	2	2	2.00	0.00
E13	20	10	15.00	7.07
E14	9	4	6.50	3.53
E15	5	4	4.50	0.70
E16	5	3	4.00	1.41

TABLE XI

Flight Check Error Scores
Stage I Control Group IFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearance	Take Off (Normal)	Straight & Level & Turns (IFR)	Altitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	ADF Approaches	VOR Approaches	Partial Panel	Mean	S.D.
C1	0	0	0	1	0	0	3	8	6	5	6	9	3.16	3.45
C2	0	3	2	0	3	0	5	1	8	7	4	5	3.16	2.72
C3	0	1	0	0	0	0	3	0	3	4	3	3	1.41	1.62
C4	0	3	0	0	0	0	0	0	5	11	8	0	2.25	3.79
C5	0	4	4	2	4	6	8	8	10	12	15	10	6.91	4.37
C6	0	10	0	0	7	5	8	11	13	21	19	16	9.16	7.24
C7	0	0	0	3	5	5	14	1	7	4	7	8	4.50	4.16
C8	0	1	0	0	4	0	2	6	12	5	4	2	3.00	3.54
C9	0	2	0	0	4	2	3	3	11	11	6	8	4.16	3.99
C10	0	0	0	0	5	2	5	1	3	1	4	7	2.33	2.42
C11	0	2	0	0	5	0	6	10	8	6	3	10	4.16	3.88
C12	0	3	0	1	4	4	8	7	18	9	13	8	6.25	5.42
C13	0	0	2	1	3	5	5	5	8	7	6	14	4.66	3.96
C14	0	3	2	0	2	2	10	1	12	6	4	3	3.75	3.79
C15	0	6	0	1	0	0	0	3	3	1	10	7	2.58	3.36

TABLE XII

Flight Check Error Scores
Stage II Experimental Group VFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns (VFR)	Altitude Transitions VFR	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Emergencies	Steep Turns (VFR)	Normal Landing	Omni Tracking	ADF Tracking	ADF Approaches	Mean	S.D.
E1	0	1	5	5	0	4	5	11	11	9	3	0	0	0	3	3.46	3.66
E2	0	0	2	6	0	3	1	12	5	6	2	5	11	2	9	4.26	3.93
E3	0	1	3	4	0	4	3	11	10	5	3	3	2	7	12	4.35	3.81
E4	0	1	0	0	0	2	3	8	8	0	3	5	2	0	14	3.06	2.78
E5	0	1	3	0	0	0	5	0	2	0	3	3	0	4	6	1.80	2.07
E6	0	2	2	1	0	2	4	5	7	0	5	3	0	7	8	3.06	2.78
E7	2	2	1	4	0	3	3	0	4	0	1	3	8	11	15	3.80	4.32
E8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E9	0	1	1	0	0	2	4	5	7	0	3	3	4	10	0	2.66	2.96
E10	0	2	1	0	0	5	0	7	7	0	1	2	3	12	14	3.60	4.53
E11	0	0	2	0	0	0	2	1	4	0	1	0	0	0	6	1.06	1.79
E12	0	1	0	0	0	2	3	4	4	0	2	0	0	1	10	1.80	2.70
E13	0	3	2	8	0	12	10	20	15	6	5	4	8	12	25	8.66	7.21
E14	0	1	0	0	0	5	2	2	7	6	3	0	0	6	10	2.80	3.23
E15	0	0	2	0	0	0	5	6	7	4	5	3	1	0	6	2.60	2.66
E16	0	2	2	1	0	4	11	10	7	10	5	5	3	0	3	4.20	3.76

TABLE XIII

Flight Check Error Scores
Stage II Private Pilot Group VFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns (VFR)	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Emergencies	Normal Landing	Mean	S.D.
P1	0	0	0	0	4	5	8	9	6	2	3.40	3.50
P2	0	2	1	0	7	14	10	5	3	4	4.40	4.69
P3	0	5	3	0	4	18	3	5	3	4	4.50	5.06
P4	0	0	6	1	8	9	6	4	0	3	3.70	3.43
P5	-	-	-	-	-	-	-	-	-	-	--	--
P6	0	1	1	1	3	11	2	7	3	0	2.90	3.51
P7	0	0	3	3	6	10	9	5	3	6	4.50	3.37
P8	2	1	0	1	5	10	5	4	0	6	3.40	3.20
P9	0	0	2	1	4	7	6	4	0	0	2.40	2.67
P10	0	0	2	4	7	10	6	4	5	4	4.20	3.08
P11	0	0	3	1	3	10	7	6	7	0	3.70	3.59
P12	0	0	4	2	5	12	4	4	6	1	3.80	3.55
P13	0	1	3	2	6	13	4	5	7	3	4.40	3.71
P14	2	0	0	0	6	5	5	4	3	0	2.50	2.41
P15	0	3	8	3	6	12	7	6	6	1	5.20	3.55

TABLE XIV

Flight Check Error Scores
Stage II Experimental Group IFR Maneuvers

	Straight & Level & Turns (IFR)	Attitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	Partial Panel	Mean	S.D.
E1	4	2	4	0	0	3	2.16	1.83
E2	5	2	4	1	11	9	5.33	2.93
E3	4	0	5	2	7	12	5.00	4.19
E4	3	0	8	2	0	14	4.50	5.50
E5	2	0	6	0	4	6	3.00	2.75
E6	1	0	6	0	7	8	3.66	3.72
E7	1	0	5	8	11	15	6.66	5.81
E8	-	-	-	-	-	-	--	--
E9	0	0	3	4	10	0	2.83	3.92
E10	4	4	3	3	12	14	6.66	4.96
E11	0	0	2	0	0	6	1.33	2.42
E12	0	0	3	0	1	10	2.33	3.93
E13	8	0	15	8	12	25	11.33	8.38
E14	0	0	3	0	6	10	3.16	4.11
E15	1	1	4	1	0	6	2.16	2.31
E16	6	0	6	3	0	3	3.00	2.68

TABLE XV

Flight Check Error Scores
Stage II Control Group IFR Maneuvers

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearances	Take Off (Normal)	Straight & Level & Turns (IFR)	Altitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	ADF Approaches	ILS Approaches	Partial Panel	Mean	S.D.
C1	0	2	1	3	2	1	11	4	6	5	10	3	4.00	3.49
C2	0	1	0	3	0	0	0	5	9	5	2	10	2.91	3.60
C3	0	3	2	5	0	0	0	4	4	11	2	8	2.25	3.46
C4	0	0	0	2	3	3	16	0	3	4	0	4	2.91	4.44
C5	0	3	2	4	0	[illegible]	11	10	21	29	17	3	8.58	9.31
C6	0	1	0	3	1	3	11	1	10	12	7	8	4.75	4.55
C7	0	3	5	2	7	3	8	11	16	12	12	17	8.00	5.60
C8	0	0	0	2	2	2	6	5	7	7	10	6	3.91	3.34
C9	0	0	0	2	0	0	7	0	10	8	18	11	4.66	6.03
C10	0	1	0	0	0	0	5	0	7	4	3	0	12.16	22.66
C11	0	1	0	1	2	1	7	0	3	9	1	6	2.16	2.36
C12	0	2	2	3	5	3	8	11	15	20	19	17	8.75	7.33
C13	0	0	0	1	0	0	8	0	0	3	5	0	1.41	2.60
C14	0	0	0	4	3	0	10	1	2	9	4	14	3.91	4.66
C15	0	2	2	1	1	3	6	4	10	7	18	9	2.25	5.17

TABLE XVI

Flight Check Error Scores
Stage III Experimental Group

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearances	Take Off (Normal)	Straight & Level & Turns (IFR)	Altitude Transitions (VFR)	Normal Landing	Omni Landing	ADF Tracking	ADF Approaches	VOR Approaches	ILS Approaches	Partial Panel	Mean	S.D.
E1	0	1	0	1	0	0	2	1	4	8	4	6	8	2.69	3.01
E2	0	1	0	0	3	2	0	4	4	3	5	4	3	2.23	1.83
E3	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E4	0	3	0	0	0	4	6	0	4	14	6	2	2	3.15	3.19
E5	0	2	0	8	1	2	0	1	12	11	7	3	9	4.30	4.44
E6	0	2	0	2	1	4	3	0	7	12	12	8	8	4.53	4.38
E7	0	2	0	3	2	3	9	2	6	10	4	6	13	4.61	3.99
E8	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E9	0	2	0	1	4	6	5	7	9	14	6	8	11	5.61	4.27
E10	0	3	0	2	3	5	9	6	12	15	10	12	9	6.61	4.90
E11	0	0	0	1	1	0	1	5	0	1	0	6	1	1.23	1.96
E12	0	0	0	0	1	2	5	0	8	14	4	8	12	4.15	4.91
E13	0	3	0	5	3	0	5	11	10	6	7	6	10	5.07	3.81
E14	0	0	0	0	0	1	0	0	7	8	9	4	1	2.30	3.44
E15	0	0	0	0	1	2	5	4	8	10	8	10	8	4.30	4.04
E16	0	3	0	0	0	4	1	1	2	3	0	9	20	3.30	5.61

TABLE XVII

Flight Check Error Scores
Stage III Control Group

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearances	Take Off (Normal)	Straight & Level & Turns (IFR)	Altitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	ADF Approaches	VOR Approaches	ILS Approaches	Partial Panel	Mean	S.D.
C1	0	0	0	1	2	0	6	3	2	1	5	9	0	2.23	2.83
C2	0	3	0	1	7	3	0	11	0	5	8	1	2	3.15	3.57
C3	0	0	0	3	0	0	9	0	0	0	0	5	7	1.84	3.15
C4	0	1	0	0	0	0	14	0	4	10	5	7	11	4.00	5.00
C5	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
C6	0	0	0	1	4	0	10	1	6	6	5	8	6	3.61	3.47
C7	0	2	0	4	1	5	3	6	13	13	10	9	12	6.00	4.88
C8	0	0	0	0	1	3	4	10	4	11	9	5	0	3.61	4.07
C9	2	1	0	0	2	0	0	9	0	2	11	0	0	2.07	3.63
C10	0	1	0	1	5	5	8	0	6	10	8	5	11	4.61	3.92
C11	0	0	0	1	2	0	4	3	1	1	3	4	7	2.00	2.12
C12	0	0	0	4	5	6	10	9	12	9	10	10	14	6.84	4.74
C13	0	1	0	0	1	1	4	6	1	1	4	2	10	2.38	2.93
C14	0	5	0	1	6	8	0	6	0	0	4	9	9	3.69	3.68
C15	0	4	0	1	3	4	4	3	3	13	6	7	8	3.30	3.56

TABLE XVIII

Flight Check Error Scores
Private Pilot Flight Check Experimental Group

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns (VFR)	Altitude Transitions (VFR)	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Accelerated Stall	Emergencies	Steep Turns (VFR)	Normal Landing	Short Field Landing	Mean	S.D.
E1	0	0	0	2	0	6	2	1	0	2	1	3	8	4	2.07	2.46
E2	0	0	0	3	0	4	3	3	1	5	0	3	3	2	--	--
E3	0	0	3	0	1	4	2	0	0	0	0	3	0	1	1.00	1.41
E4	0	0	2	0	0	5	0	2	3	2	0	6	3	1	1.71	1.97
E5	0	0	4	0	2	3	9	0	3	2	1	2	0	1	1.92	2.43
E6	0	0	2	2	0	0	2	5	0	3	0	1	2	1	1.28	1.48
E7	0	0	0	1	0	4	8	4	1	4	0	3	0	1	1.85	2.41
E8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E9	0	0	4	0	2	1	5	1	0	1	1	1	3	1	1.42	1.55
E10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E11	0	0	0	0	0	2	2	1	0	4	1	1	3	2	1.14	1.29
E12	0	0	2	0	0	3	1	0	2	4	0	0	0	1	0.92	1.32
E13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E14	0	0	1	4	0	3	3	0	4	3	0	2	0	1	1.50	1.60
E15	0	0	6	2	0	5	6	1	1	0	2	3	3	2	2.21	2.15
E16	0	0	6	3	2	2	0	1	4	1	3	2	0	0	1.71	1.81

TABLE XIX

Flight Check Error Scores
Private Pilot Flight Check Private Pilot Group

	Pre-Flight Procedures	Taxi and Run-Up	Take Off (Normal)	Straight & Level & Turns (VFR)	Altitude Transitions (VFR)	Slow Flight	Traffic Patterns	Approach to Landing Stall	Take Off and Departure Stall	Accelerated Stall	Emergencies	Steep Turns (VFR)	Normal Landing	Short Field Landing	Mean	S.D.
P1	0	0	4	1	3	5	7	1	1	5	1	2	4	5	2.78	2.22
P2	0	0	2	2	1	6	4	0	2	0	0	2	9	1	2.07	2.64
P3	0	0	3	2	1	5	9	3	4	6	6	0	2	4	3.21	2.66
P4	0	0	1	1	1	4	4	1	2	1	0	2	1	3	1.50	1.34
P5	0	0	3	3	0	3	0	0	3	4	1	5	0	1	1.64	1.78
P6	0	0	4	2	1	0	7	0	5	4	2	2	0	2	2.07	2.20
P7	0	0	4	2	1	9	11	6	2	8	0	1	1	2	3.35	3.67
P8	0	0	6	2	1	7	8	4	4	3	3	5	2	4	3.50	2.44
P9	0	0	1	2	1	5	11	2	8	1	3	0	0	6	2.85	3.41
P10	0	0	1	2	1	4	4	4	2	5	3	0	0	4	2.14	1.83
P11	0	0	2	2	1	1	5	3	5	6	3	1	5	5	2.78	2.08
P12	0	0	2	2	1	7	11	4	4	8	0	5	2	0	3.28	3.42
P13	0	1	0	2	1	3	6	6	4	5	0	1	2	2	2.35	2.13
P14	0	0	3	2	0	4	6	3	4	1	6	7	0	2	2.71	2.43
P15	0	0	2	2	1	0	9	6	4	3	-	2	4	2	2.50	2.59

TABLE XX

Flight Check Error Scores
Final Instrument Evaluation - Experimental Group

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearances	Straight & Level & Turns (IFR)	Altitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	ADF Approaches	ILS Approaches	Holding Patterns	Partial Panel	Mean	S.D.
E1	0	0	0	3	0	2	8	0	4	4	10	5	3.00	3.38
E2	0	1	0	2	0	5	2	2	6	14	22	10	5.33	6.82
E3	0	4	0	10	3	2	2	12	8	8	9	8	5.50	4.12
E4	0	2	4	0	0	10	8	14	6	30	10	15	8.25	8.65
E5	0	2	2	2	1	5	14	14	7	16	14	4	6.75	6.03
E6	0	2	0	0	0	8	10	16	22	6	0	0	5.33	7.40
E7	0	0	0	0	0	9	10	15	12	5	12	22	4.08	7.39
E8	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E9	0	0	0	0	0	0	2	24	27	21	40	7	10.08	14.07
E10	0	0	0	3	0	4	3	4	3	4	6	1	2.33	4.05
E11	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E12	0	0	0	4	0	4	7	13	14	2	9	8	5.08	5.08
E13	-	-	-	-	-	-	-	-	-	-	-	-	--	--
E14	0	3	3	4	0	9	5	15	6	16	26	7	7.83	7.66
E15	0	2	3	2	4	12	11	20	19	24	19	14	10.83	8.44
E16	0	0	0	0	0	18	16	22	25	25	23	4	10.41	11.00

TABLE XXI

Flight Check Error Scores
Final Instrument Evaluation - Control Group

	Pre-Flight Procedures	Taxi and Run-Up	IFR Clearances	Straight & Level & Turns (IFR)	Altitude Transitions (IFR)	Steep Turns (IFR)	Omni Tracking	ADF Tracking	ADF Approaches	ILS Approaches	Holding Patterns	Partial Panel	Mean	S.D.
C1	0	0	0	1	2	2	3	5	0	10	1	14	3.16	4.46
C2	0	0	2	0	0	0	0	0	0	0	0	0	0.16	0.57
C3	0	0	0	1	0	1	0	3	4	0	0	0	0.75	1.35
C4	0	0	0	0	1	2	0	2	3	0	0	3	0.91	1.24
C5	-	-	-	-	-	-	-	-	-	-	-	-	--	--
C6	0	0	2	4	0	13	13	23	22	7	11	19	9.50	8.62
C7	-	-	-	-	-	-	-	-	-	-	-	-	--	--
C8	0	0	0	4	0	2	5	4	0	0	8	0	1.91	2.71
C9	0	0	0	3	0	1	0	0	0	0	5	7	1.33	2.38
C10	0	1	0	1	2	12	0	5	5	3	11	8	4.00	4.28
C11	0	0	0	4	0	0	2	2	1	2	2	4	4.41	1.50
C12	-	-	-	-	-	-	-	-	-	-	-	-	--	--
C13	0	0	2	1	3	1	5	2	4	2	0	8	2.33	2.38
C14	0	0	0	0	0	0	0	0	2	0	0	0	0.16	0.57
C15	0	0	0	0	4	2	0	2	0	2	7	3	1.66	2.18

TABLE XXII

Summary-Student Flight Performance
Experimental Group
(Average Error Score)

Student	Stage I VFR	Stage I IFR	Stage II VFR	Stage II IFR	Stage III	Private Test	Instrument Test
1	3.36	2.00	3.46	2.16	2.69	2.07	3.00
2	5.27	5.50	4.20	5.33	2.23	--	5.33
3	8.90	4.00	4.53	5.00	--	1.00	5.50
4	4.63	3.00	3.06	4.50	3.15	1.71	8.25
5	1.72	5.00	1.80	3.00	4.30	1.92	6.75
6	7.00	8.00	3.06	3.66	4.53	1.28	5.33
7	2.63	5.00	3.80	6.66	4.61	1.85	7.08
8	5.00	4.50	--	--	--	--	--
9	7.09	4.50	2.66	2.83	5.61	1.42	10.08
10	6.63	7.50	3.60	6.66	6.61	--	--
11	3.45	0.50	1.06	1.33	1.23	1.14	2.33
12	5.00	2.00	1.80	2.33	4.15	0.92	5.08
13	10.27	15.00	8.66	11.33	5.07	--	--
14	6.09	6.50	2.80	3.16	2.30	1.50	7.83
15	5.18	4.50	2.60	2.16	4.30	2.21	10.83
16	8.36	4.00	4.20	3.00	3.30	1.71	10.41
Mean	5.66	5.09	3.42	4.21	3.86	1.56	6.75
S.D.	5.66	3.98	4.03	4.69	4.13	1.85	7.85

TABLE XXIII

Summary-Student Flight Performance
Private Pilot Group
(Average Error Score)

Student	Stage I VFR	Stage II VFR	Private Test
1	3.00	3.40	2.78
2	5.80	4.40	2.07
3	4.10	4.50	3.21
4	4.10	3.70	1.50
5	5.60	--	1.64
6	5.10	2.90	2.07
7	6.70	4.50	3.35
8	11.30	3.40	3.50
9	5.00	2.40	2.85
10	5.40	4.20	2.14
11	3.80	3.70	2.78
12	5.50	3.80	3.28
13	3.30	4.40	2.35
14	3.00	2.50	2.71
15	10.30	5.20	2.50
Mean	5.46	3.78	2.58
S.D.	5.45	3.50	2.52

TABLE XXIV

Summary-Student Flight Performance
Control Group
(Average Error Score)

Student	Stage I	Stage II	Stage III	Final Instrument Check
1	3.16	4.00	2.23	3.16
2	3.16	2.91	3.15	0.16
3	1.41	3.25	1.84	0.75
4	2.25	2.91	4.00	0.91
5	6.91	8.58	--	--
6	9.16	4.75	3.61	9.50
7	4.50	8.00	6.00	--
8	3.00	3.91	3.61	1.91
9	4.16	4.66	2.07	1.33
10	2.33	12.16	4.61	4.00
11	4.16	2.16	2.00	1.41
12	6.25	8.75	6.84	--
13	4.66	1.41	2.38	2.33
14	3.75	3.91	3.69	0.16
15	2.58	5.25	4.30	1.66
Mean	4.10	5.11	3.59	2.27
S.D.	4.35	7.87	3.91	4.11

Figure 1 shows the graph of the groups' mean error scores as a function of total flight time for the VFR maneuvers. The following observations can be made:

a. The private pilot control group has a faster rate of improvement up to the Stage II flight check. Then both progress at the same rate until private pilot certification.

b. The experimental group reaches a significantly lower error score at certification than the control group.

c. When the second half of the experimental group took their certification rides after the instrument evaluations they remained at the same low error level as the first half. This suggests a "true" leveling off of accomplishment. And, if so, it then implies the margin for improvement for the control group.

This graph can also be used to suggest that scores for minimum standards for a private pilot certification occurs somewhere above a mean error score of 2.6.

The graphs of the grand mean error scores for the IFR performance appears in Fig. 2, which is extremely informative.

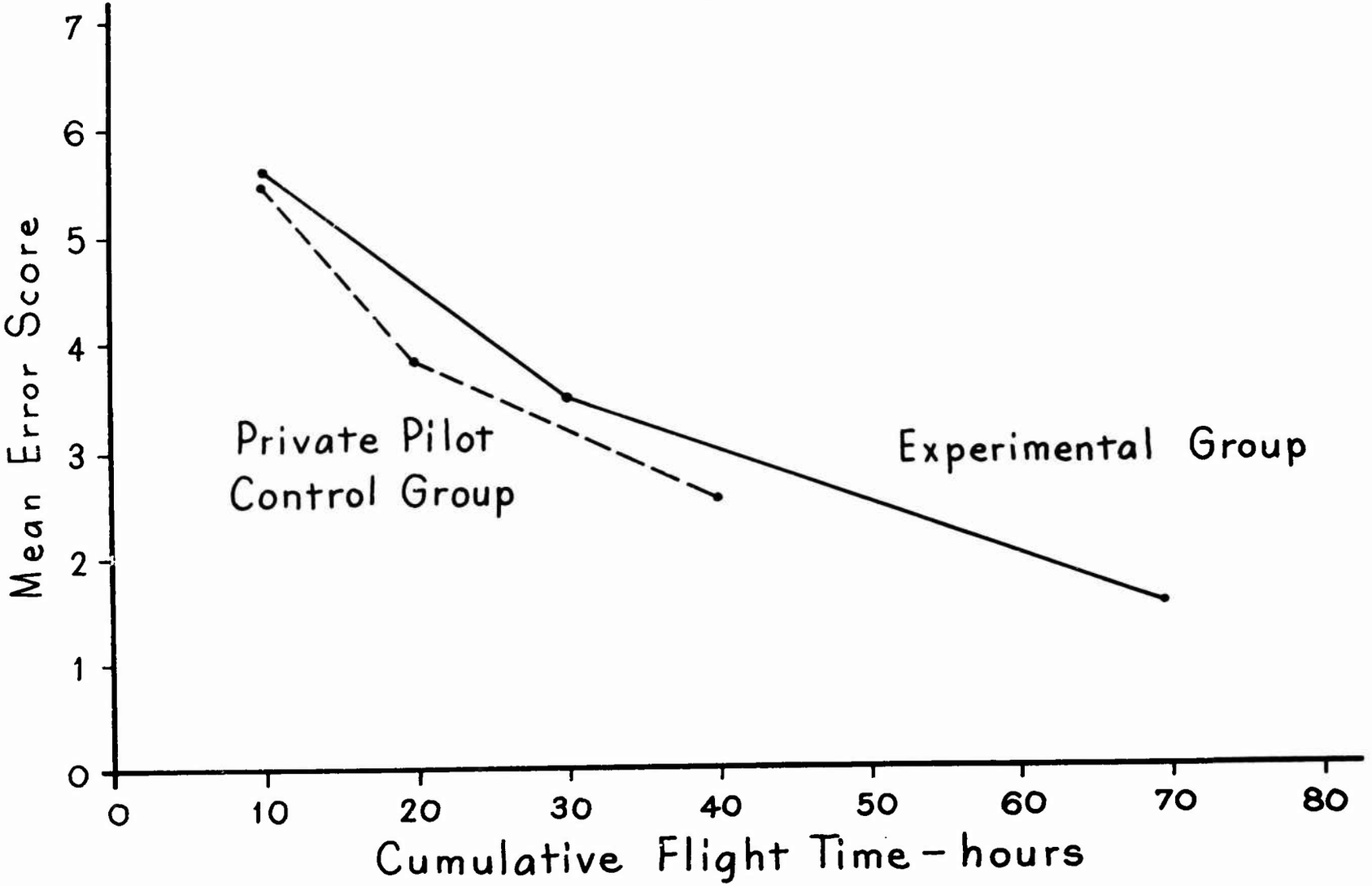
The performance of the instrument control group shows an increase in error score for the Stage II flight check, and then a fairly uniform rate down until completion. Stage II is relatively difficult when compared to the Stage I check (See Appendix F). Since the mean error score at completion represents the average performance for twelve students, nine of whom passed and received the instrument rating, this value of about 2.3 is considered to be fairly close to the score for minimum instrument qualification (or standards).

In reviewing the overall performance of the experimental group's IFR performance (Fig. 2), the students show a slow but steady improvement through their Stage III flight checks. One aspect of these scores is that they do not show the relative increase in difficulty of the flight checks. In spite of this, the trend of general improvement cannot be denied them; however, the final instrument evaluation indicates dramatically the failures of the experimental group.

One procedural change is involved in this particular performance curve. The first three stage checks were made by the school examiner (the chief flight instructor). The final instrument evaluation was conducted by FAA personnel. It was thought at first that the grading system used by the FAA personnel was different from that used by the school; however, this was found not to be the case. The bad performances were admitted to by the students themselves and verified by the school's designated instrument examiner when he "spot checked" one of the students.

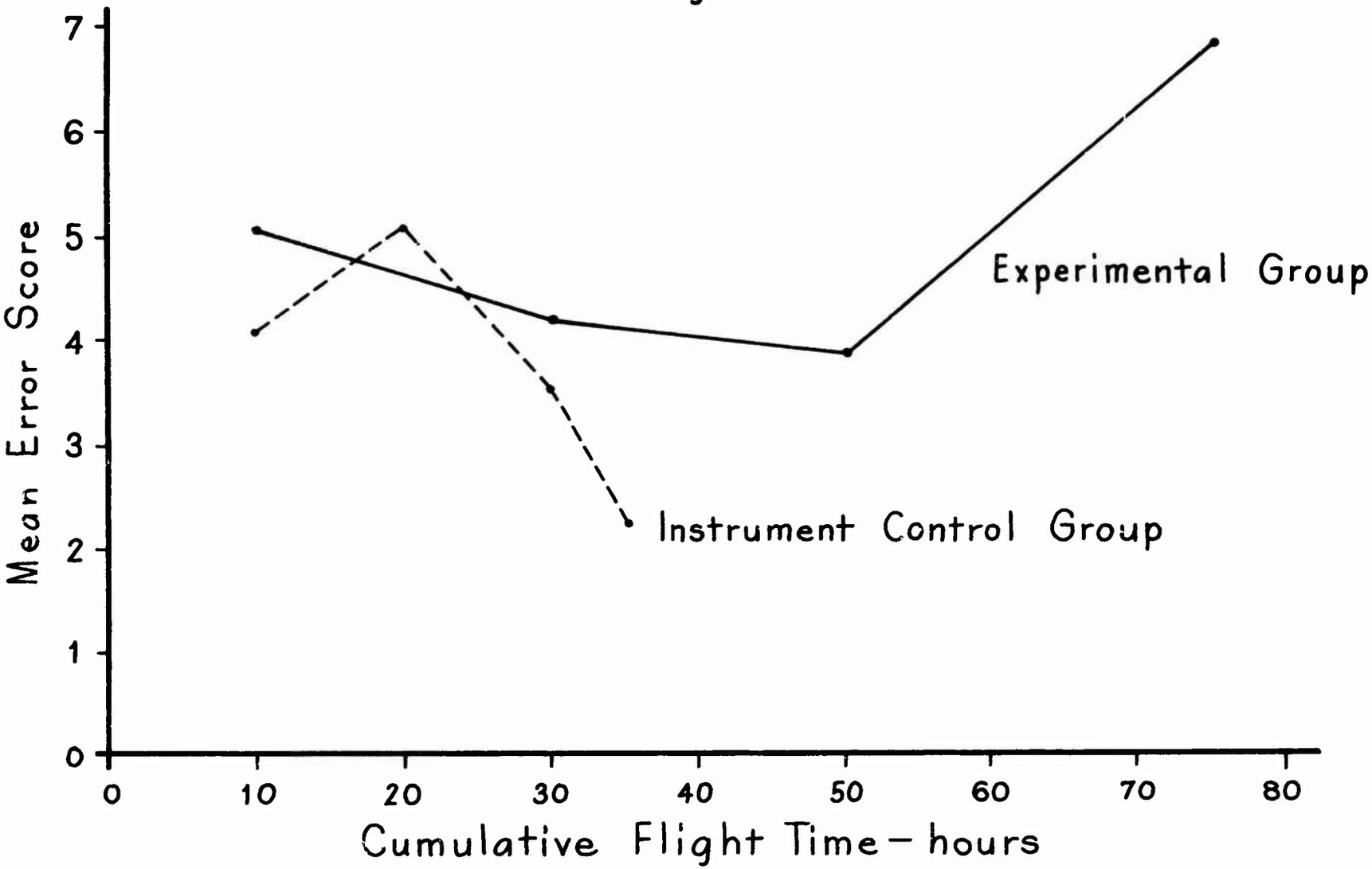
Comparison of VFR Performance

Fig. 1-



Comparison of IFR Performance

Fig. 2-



Although a great deal more will be said about the experimental group's performance, it should be mentioned that each of the students' instructors were surprised by the final performances of their students. In some cases the instructor knew that the student would not pass, but in all cases the instructors were surprised by some of the things the students did.

Considering now the statistical comparisons between all the groups, the differences described above can be put into more quantitative terms. Table XXV shows the statistical evaluation between the experimental group and the private pilot control group for those VFR maneuvers common to both groups. Of the three comparisons, only the private pilot certification performance is significant and favors the experimental group. It is interesting that the significance level of 0.15 is only statistically marginal, in light of the unequivocal examiner's opinions.

Table XXVI presents the four statistical comparisons for the common IFR performances. Again, the only statistically significant difference is the final instrument evaluation.

As in so many evaluations of overall performance, the error score is a sum of individual or maneuver scores. Thus, it is possible that the overall score, as a single number, smoothes out the low-scoring and high-scoring maneuvers. Therefore, it is appropriate to investigate the groups' relative performances by comparing error scores on the separate maneuvers.

Tables XXVII to XXXI present by maneuver and for each flight check the mean error score for each group and their differences. It should be noted that a negative difference indicates a performance in favor of the experimental group. Those maneuvers which are statistically significant are presented in Tables XXXII to XXXIV, and the maneuvers so shown are ranked in order of decreasing t value (or significance). All maneuvers having a significance level greater than 0.25 are to be considered as having no significance whatever and thus are omitted from this last group of tables.

At the Stage I VFR flight checks, the experimental group is better in slow flight than the control group. This may be attributable to the early development in the experimental group of throttle-pitch coordination and control, a coordination that is fundamental to instrument flight. Departure stalls were better performed by the control group. It is believed that this is the result of fewer exposures by the experimental group. At a less significant level, straight and level, and turns, were better in the control group, and, again, relative exposure may be the explanation. Why the experimental group should be better at approach stalls is not apparent.

TABLE XXV

Statistical Comparison of Overall
Flight Performance Scores (VFR)

Comparisons	Stage I VFR	Stage II VFR	Private Flight Test
EXP - PRIMARY			
Difference in mean scores	+.20	-.36	-1.02
t Value	.10	-.25	-1.21
d. f.	30.00	28.00	23.00
Significance Level	--	.40	.15

TABLE XXVI

Statistical Comparison of Overall
Flight Performance Scores (VFR)

Comparisons	Stage I IFR	Stage II IFR	Stage III IFR	Instrument Test
EXP- CONTROL				
Difference in Mean Scores	.99	-.90	.27	4.48
t Value	.66	-.38	.17	1.81
d.f.	30.00	20.00	26.00	20.00
Significance Level	.30	.40	--	.05

TABLE XXVII

Summary - Stage I Flight Check Maneuvers
Average Error Score

	VFR			IFR		
	Experimental	Primary	Diff.	Experimental	Control	Diff.
Pre-Flight Procedures	0.12	0.13	-0.00			
Taxi and Run-Up	1.75	1.33	0.41			
Take Off (Normal)	6.06	7.60	-1.53			
Straight & Level & Turns (VFR)	4.18	2.73	1.45			
Altitude Transitions (IFR)				5.50	2.06	3.43
Slow Flight	5.31	7.33	-2.02			
Traffic Patterns	9.43	10.66	-1.22			
Approach to Landing Stall	7.18	8.66	-1.47			
Take Off & Departure Stall	8.00	6.40	1.60			
Emergencies	6.00	6.06	-0.06			

TABLE XXVIII

Summary - Stage II Flight Check Maneuvers
Average Error Score

	VRF			IFR		
	Experimental	Primary	Diff.	Experimental	Control	Diff.
Pre-Flight Procedures	0.13	0.28	-0.15			
Taxi and Run-Up	1.20	0.92	0.27			
Take Off (Normal)	1.73	2.57	-0.83			
Straight & Level & Turns (VFR)	1.93	1.35	0.57			
Straight & Level & Turns (IFR)				2.60	1.73	0.86
Altitude Transitions (IFR)				0.60	1.46	-0.86
Slow Flight	3.20	5.28	-2.08			
Traffic Patterns	4.06	10.42	-6.36			
Approach to Landing Stall	6.80	5.85	0.94			
Take Off & Departure Stall	7.00	5.14	1.85			
Emergencies	2.73	3.57	-0.83			
Steep Turns (IFR)				5.13	7.60	-2.46
Normal Landing	2.60	2.42	0.17			
Omni Tracking				2.13	3.73	-1.60
ADF Tracking				5.40	7.73	-2.33
Partial Panel				9.40	9.73	-0.33

TABLE XXIX

Summary-Stage III Flight Check Maneuvers
Average Error Scores

	IFR		
	Experimental	Control	Diff.
Pre-Flight Procedures	0.	0.14	-0.14
Taxi and Run-Up	1.57	1.28	0.28
IFR Clearances	0.	0.	0.
Take Off (Normal)	1.64	1.28	0.35
Straight & Level & Turns (IFR)	1.42	2.78	-1.35
Omni Tracking	3.00	4.78	-1.78
ADF Tracking	6.64	3.71	2.92
ADF Approaches	9.21	5.85	3.35
VOR Approaches	5.85	6.28	-0.42
ILS Approaches	6.57	5.78	0.78
Partial Panel	8.21	6.92	1.28

Table XXX

Summary - Private Pilot Test Maneuvers
Average Error Scores

	VFR		
	Experimental	Primary	Diff.
Pre-Flight Procedures	0.	0.	0.
Taxi and Run-Up	0.	0.06	-0.06
Take Off (Normal)	2.50	2.53	-0.03
Straight & Level & Turns (VFR)	1.16	1.93	-0.76
Altitude Transitions (VFR)	0.58	1.00	-0.41
Slow Flight	3.16	4.20	-1.03
Traffic Patterns	3.33	6.80	-3.46
Approach to Landing Stall	1.33	2.86	-1.53
Take Off & Departure Stall	1.50	3.60	-2.10
Accelerated Stall	2.16	4.00	-1.83
Emergencies	0.75	1.86	-1.11
Steep Turns (VFR)	2.25	2.33	-0.08
Normal Landing	1.83	2.13	-0.30
Short Field Landing	1.33	2.86	-1.53

Table XXXI

Summary - Instrument Flight Test Maneuvers
Average Error Score

	Experimental	Control	Diff.
Pre-Flight Procedures	0.	0.	0.
Taxi and Run-Up	1.23	0.08	1.14
IFR Clearances	0.92	0.50	0.42
Straight & Level & Turns (IFR)	2.30	1.58	0.72
Altitude Transitions (IFR)	0.61	1.00	-0.83
Steep Turns (IFR)	6.15	3.00	3.15
Omni Tracking	7.53	2.33	5.20
ADF Tracking	13.15	4.00	9.15
ADF Approaches	12.23	3.41	8.81
ILS Approaches	13.46	2.16	11.29
Holding Patterns	15.38	3.75	11.63
Partial Panel	8.07	5.50	2.57

TABLE XXXII

Significant Flight Maneuvers

Maneuver	Mean Error Difference	t Value	d.f.	Significance Level
Stage I Check Flight (VFR)	(E-P)			
Slow Flight	-2.02	-1.51	28	.10
Take Off & Departure Stalls	1.60	1.37	27	.10
Straight & Level & Turns (VFR)	1.45	1.08	23	.20
Approach to Landing Stall	-1.47	1.02	31	.20
Stage I (IFR)	(E-C)			
Altitude Transitions	3.43	3.36	29	.001
Stage II (VFR)	(E-P)			
Traffic Patterns	6.36	-5.28	28	.0005
Slow Flight	-2.08	-2.40	22	.025
Take Off & Departure Stalls	1.85	2.01	21	.03
Take Off	-0.83	-1.18	22	.15
Emergencies	-0.83	-0.75	28	.25
Straight & Level & Turns (VFR)	0.57	0.73	21	.25

TABLE XXXIII

Significant Flight Maneuvers

Maneuver	Mean Error Difference	t Value	d.f.	Significance Level
Stage II (IFR)	(E-C)			
Steep Turns	-2.46	-1.83	28	.05
Altitude Transitions	-0.86	-1.82	29	.05
Omni Tracking	-1.60	-1.26	26	.12
ADF Tracking	-2.33	-1.14	29	.15
Straight & Level & Turns	0.86	1.03	29	.15
Stage III (IFR)	(E-C)			
ADF Tracking	2.92	1.96	27	.03
Straight & Level & Turns	-1.35	-1.93	22	.03
ADF Approaches	3.35	1.84	28	.05
Omni Tracking	-1.78	-1.30	27	.10
Pre-Flight Procedure	-0.14	-1.00	13	.15

TABLE XXXIV

Significant Flight Maneuvers

Maneuver	Mean Error Difference	t Value	d.f.	Significance Level
Private Pilot Flight Check	(E-P)			
Short Field Landings	-1.53	-2.90	24	.003
Take Off and Departure Stalls	-2.10	-3.24	26	.003
Traffic Patterns	-3.46	-2.92	26	.005
Accelerated Stalls	-1.83	-2.37	25	.01
Approach Stall	-1.53	-2.10	27	.03
Emergencies	-1.11	-1.83	22	.05
Straight & Level & Turns	-0.76	-1.81	13	.05
Altitude Transitions	-0.41	-1.34	21	.10
Slow Flight	-1.03	-1.23	26	.12
Instrument Flight Test	(E-C)			
ILS Approaches	11.29	4.09	15	.0005
ADF Tracking	9.15	3.37	25	.001
Holding Patterns	11.63	3.67	17	.001
ADF Approaches	8.81	3.01	24	.003
Omni Tracking	5.20	3.05	25	.003
Taxi and Run-Up	1.14	2.96	13	.006
Steep Turns	3.15	1.89	23	.05
Partial Panel	2.57	1.06	25	.15
IFR Clearances	0.42	0.86	21	.20

For the Stage I IFR maneuvers, there was only one maneuver for comparison, and it was, as expected, to be better performed by the instrument control group. Relative instrument exposure at this stage was more than twice that of the experimental group.

The significant VFR maneuvers on the Stage II flight check were consistent with performances as on the Stage I flight check; i.e., slow flight, departure stalls, and straight and level. The major addition to this list was traffic patterns, favored the control significantly. The explanation is straightforward when the relative exposure time is considered. At this checkpoint the control group preparing for solo cross-country, whereas many of the experimental students had only recently soloed.

Surprisingly, the significantly different IFR maneuvers on the Stage II check favored the experimental group. The experimental group reversed itself and did better on altitude transitions, but were poor on IFR straight and level, as they were on VFR straight and level.

At the Stage III flight check, there were performance reversals on ADF tracking, and straight and level. The fact that pre-flight procedures show up as a significant difference in favor of the experimental group points to the common danger of statistical testing. The experimental group had no students with zero errors while the control group had one student with a 2-point error.

There is little that can be added about the specific maneuvers shown in Table XXXIV, the final private and instrument flight checks. The significance levels and direction are consistent.

DISCUSSION

In this section we will attempt to relate the results of the preceding section to the experimentation program objectives. The most important objective was the development and evaluation of a combined VFR-IFR curriculum. The results obtained in this program strongly indicate that the experimental curriculum is lacking in a number of areas, the most serious being the area of pilot "maturity" and "judgment" for the instrument capability.

The experimental curriculum did develop superior private pilots. This was to be expected, in view of the great amount of instructional time and greater exposure to the National Airspace System than is normally given in the standard private pilot curriculum. However, this difference may be misleading if one considers the opportunities and incentives for the standard private pilot to upgrade himself as he acquires more flight time.

As for the more significant finding of this program, (namely, the inability of the experimental students to achieve instrument rating proficiency), it was established that the experimental students could perform the basic instrument skills and the more complex skills if these skills were not hindered by communications, emergencies, or multiple concurrent tasks. Thus it became obvious that these experimental students in this particular curriculum could not put all the skills together so as to achieve the minimum instrument rating standards.

There are at least three major reasons for the observed results. These reasons may be valid individually or in combination.

The first is the basic design of the experimental curriculum. It is possible that the curriculum failed to develop the student's sense of judgment and self-reliance. It is also possible that the curriculum failed to recognize the importance of time to first solo, and solo cross-country experiences. It may also have failed to effectively proportion or integrate the VFR-IFR skills.

The second major reason may be the inability of the instructors to follow the experimental curriculum. It is not meant to imply that the instructors were themselves incapable, but that the students' daily progress required significant changes in the level and type of instruction. To investigate this possibility, a procedure was established whereby the instructor reported weekly on the problems and changes in the curriculum. A chart was used by the instructor to provide a period-by-period reference as to each student's progress in terms of the number of periods in which a maneuver was demonstrated and practiced. This procedure provided some measure of quality control in that this chart was compared with a master chart prepared from the experimental syllabus.

TABLE XXXV

Comparison of Syllabus Exposures with Logbook Exposures

	St & L & Turns VFR	Altitude Transitions VFR	Slow Flight	Approach to Landing Stall	T.O. & Dep. Stall	Accelerated Stall	Emergencies	Steep Turns VFR	IFR Clearances	St & L & Turns IFR	Altitude Transitions IFR	Cont Tracking	ADF Tracking	ADF Approaches	VOR Approaches	ILS Approaches	Holding	Partial Panel
E1	9	4	13	19	12	6	4	4	19	13	10	9	16	7	3	9	7	5
E2	13	9	16	20	17	9	4	4	11	14	14	10	15	4	6	3	5	7
E3	14	11	9	21	16	10	10	6	8	13	11	19	9	4	6	4	5	2
E4	6	6	16	22	23	12	6	4	11	12	12	13	14	9	6	6	2	7
E5	11	9	16	16	15	8	12	4	8	12	18	9	5	6	3	13	6	4
E6	9	10	24	21	20	9	9	4	8	12	12	12	10	7	8	10	4	4
E7	10	13	21	17	18	14	17	7	6	14	9	10	9	4	11	14	4	3
E9	10	8	15	25	25	8	9	9	13	12	12	11	9	16	13	11	7	10
E11	4	4	12	15	11	9	8	6	16	13	13	6	7	12	10	24	5	8
E12	7	5	11	13	15	11	5	0	6	8	7	6	7	2	4	4	6	3
E14	11	11	6	16	14	8	3	17	7	11	10	11	12	12	5	0	3	1
E15	8	8	9	18	20	13	9	6	5	9	12	12	12	3	2	1	3	4
E16	8	5	10	18	15	9	10	4	16	7	6	12	8	10	6	7	4	3
Mean	9.2	7.9	13.7	18.5	17.0	9.7	8.1	6.3	10.1	11.5	11.2	10.7	9.5	8.2	6.4	8.1	4.7	4.7
Scheduled	9	7	6	20	20	12	14	7	21	6	6	12	11	13	13	8	14	6
Difference	+.2	+.9	+7.7	-1.5	-3.0	-2.3	-5.9	-.7	-10.9	+5.5	+5.2	-1.3	-1.5	-4.8	-6.6	+.1	-9.3	-1.3
	← VFR Maneuvers →									← IFR Maneuvers →								

At the end of the program, all of the instructor charts were summarized. By counting the number of actual exposures for each curriculum element and then comparing this number with the curriculum's scheduled number, some significant differences were observed. These data appear in Table XXXV.

On the average, more exposures thatn planned were required for the VFR skills, and fewer than planned were required for the IFR skills. It is believed that this imbalance in following the experimental syllabus may be a result of slower learning rate created by the integrated VFR-IFR techniques in the early stages of the syllabus, thus leaving insufficient time for the advanced IFR stages. It is possible that the instructional techniques for teaching the integrated concepts require refinement and more familiarity. It is also possible that the instructors, through their conscientiousness, exaggerated the importance of the early stages.

The third major reason is based on the intangible and subjective values given to solo cross-country experiences. The experimental syllabus provided for the minimum time of six hours solo cross-country as required for the private pilot certificate under FAA-approved school regulations. Table XXXVI compares the amount of cross-country experience between the experimental group and the instrument control group. The differences are striking.

There is extremely strong feeling on the part of the program's two principal investigators and the instructional staff that the lack of cross-country experience is responsible for the experimental students' lack of self reliance and judgment to handle the stressful tasks required for the instrument rating.

Another possible factor contributing to the instrument weaknesses of the experimental students was the amount of instructional time received was less than that scheduled in the syllabus. As can be seen from Fig. 3, in 60 periods, the experimental group received an average of 25 hours of instrument instruction when the syllabus called for 35 hours. Similarly, the average flight time obtained by the experimental students was 66 hours compared to the 71 hours in the syllabus.* Thus, it is apparent that there were significant changes from the syllabus. Many of the changes were judged necessary by the instructor in order to meet the individual students' needs. Since the experimental students were not committed to paying for more than 70 hours, this limit developed into an experimental constraint. That is, deviations from the syllabus were more freely made toward the end in order to overcome possible private pilot deficiencies.

A reasonable question to ask is, "how much additional time would the experimental students require in order to meet the instrument

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* These numbers should not be confused with the total hours actually received by the student. In almost all cases, the students flew considerably more than the 60 periods originally programmed.

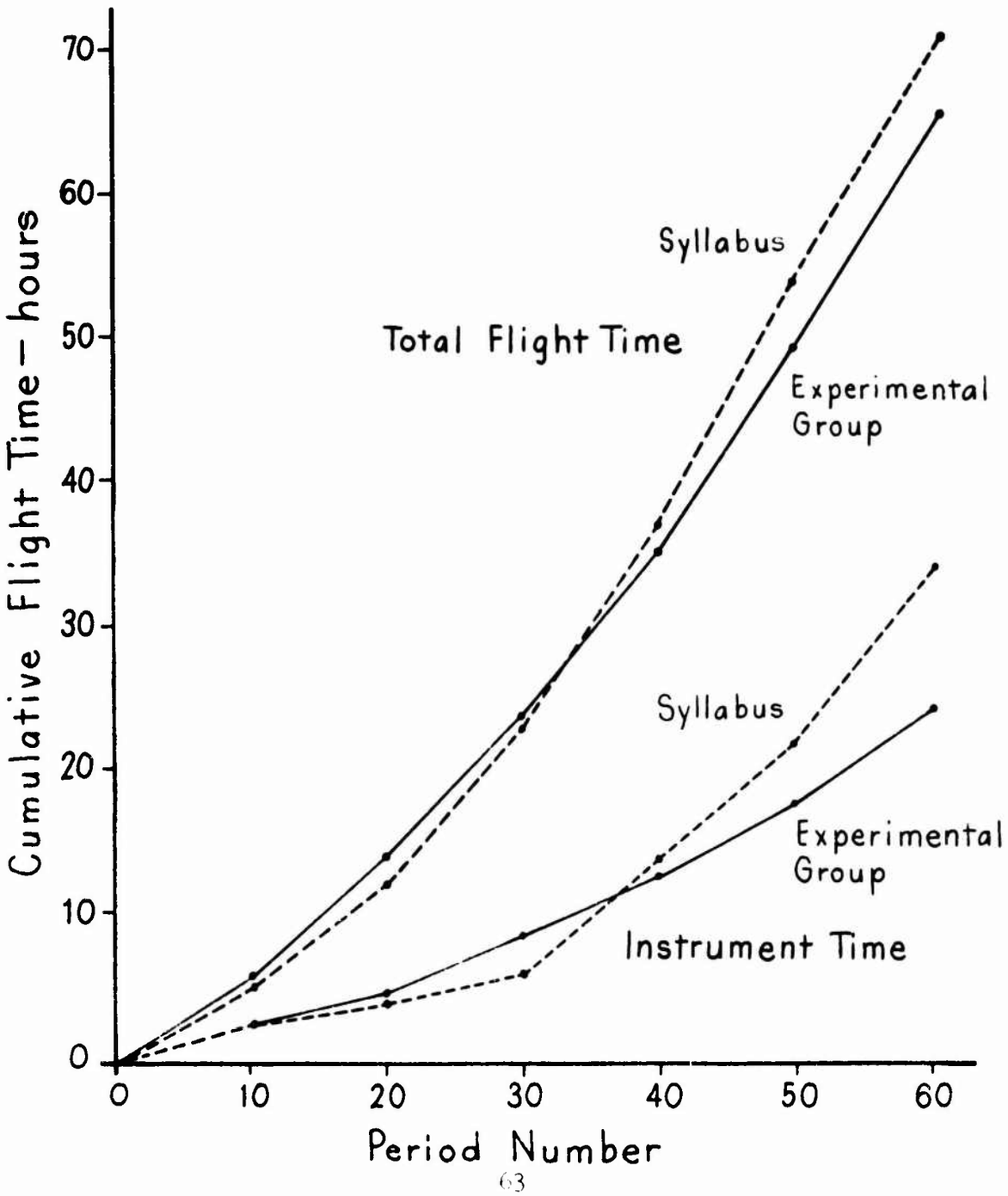
TABLE XXXVI

Comparison of Cross-Country Experience

Student	Instrument Control Group X-C Time	Geographical Area of U.S.	Dual Instruction Received Since Private	Student	Experimental Group Solo X-C Time	Ground Trainer Time
C1	50	Central	5	E1	6.3	7.9
C2	50	Central, SW	30	E2	6.9	5.8
C3	350	East, Central	10	E3	6.1	5.3
C4	-	--	--	E4	6.8	6.7
C5	dropped	--	--	E5	6.5	8.2
C6	80	Central	10	E6	7.0	4.0
C7	55	East, Central, North	2	E7	6.7	8.3
				E8	1.9	3.4
C8	300	Entire	50	E9	8.9	4.7
C9	50	Central	35	E10	6.2	7.5
C10	100	East, Central	30	E11	6.2	9.5
C11	250	East, Central, North	15	E12	7.1	9.0
				E13	6.9	8.2
C12	100	Central, SE	50	E14	7.9	6.8
C13	90	Ohio, SE	0	E15	6.7	7.5
C14	100	East, Central	30	E16	6.7	19.0
C15	-	--	--			
Mean	131		22		6.6	7.6
N	12		12		16	16

Comparison of Experimental Syllabus Time with Actual Time

Fig. 3-



rating standards?" However, from the data points showing error rates in Fig. 2, an estimate of time cannot be made with any kind of reliability. One clue might be the two students who continued to 90 and 109 hours, but without success, although both students evoked the FAA examiner's comment that the student probably needed only 2-5 more hours (Appendix J).

The limited use of the Link C-8 ground trainer is believed to have been an important factor in the program's results. That is, excessive and unnecessary use of the aircraft may have been avoided had the student used a more appropriate ground trainer to develop the instrument skills and IFR procedures. Table XXXVI shows the average use of the ground trainer as 7.6 hours, of which three hours were at the very beginning of the training program.

Student and instructor comments were obtained to indicate more personal feelings to the experimental curriculum and its results (Appendices H and I). The following questions were asked of the students:

1. At the completion of the program, do you feel competent to fly an aircraft on actual instruments?

2. Do you feel additional exposure to VFR flight is necessary to help you achieve skills that are essential to instrument flight? Please elaborate.

3. Do you feel that early introduction to instrument flight aided or retarded your progress? Explain.

4. Has your desire to work toward an instrument rating been intensified or reduced? Explain.

The students' answers generally reflected a sense of confidence to handle an inadvertant encounter with IFR weather, and yet they admitted they did not feel qualified to operate IFR in the current National Airspace System.

Most of the students felt that additional VFR training, particularly more solo time, would have benefited their IFR skills. Other than improving their confidence, they were vague as to exactly how the VFR training would aid IFR skills.

Almost all of the students felt that early introduction to instrument flight training aided their progress. They strongly felt that they were more competent private pilots than those going through the standard primary program. As to their desire to obtain an instrument rating, all of the students sincerely expressed their intention to obtain the instrument rating. Now that they know the extent of the ATC system, their training enabled them to develop a high level of appreciation for

the ATC system and for the increased utilization that the instrument rating affords.

For the instructors, the following set of questions was asked at the completion of the program:

1. What changes would you suggest in the IFR-VFR program to help achieve private and instrument proficiency in 80 flight hours?

2. What is your opinion of an 80-hour private pilot with an instrument rating flying in actual conditions, considering the present state of the art?

3. Do your believe that in an intensive primary and instrument program, an "average" student can achieve an instrument rating in 80 hours? Elaborate.

4. Elaborate on how this type of integrated instrument program aids or detracts from student progress?

The opinions of the instructors generally favored the curriculum but recommended modifications to increase the amount of VFR training and solo experience. All instructors felt that 80 hours was not sufficient to develop the private pilot with instrument rating. There is consistency in the observation that these students lacked the "maturity" to handle the unexpected situations. Because of this, each instructor was expressive about not wanting to fly IFR in the same airspace with these students if they were licensed! Each instructor felt that this integrated program developed a superior private pilot; a type of pilot who would operate well in the ATC system in a VFR capacity.

CONCLUSIONS

1. Using the integrated VFR-IFR curriculum developed for this experiment, it was not possible to train private pilots with instrument ratings in the scheduled 75 to 80 hours flight time.

2. At the end of 75 to 80 hours flight time the experimental students were significantly deficient in such qualities as "seasoning," "self-reliance," and "judgment." This was evident in their inability to anticipate and to make and carry out correct decisions in the event of emergencies and communications congestion.

3. No estimate of the total flight time the experimental group would require to meet instrument rating standards can be reliably made.

4. The value of the "block" concept of introducing and performing a maneuver by instrument reference first and then by contact references could not be objectively evaluated because of continuing curriculum changes.

5. The integrated VFR-IFR curriculum for this experiment was difficult to follow. This resulted in insufficient instrument instruction.

6. The value of solo cross-country training was underestimated in the experimental curriculum.

7. The use of ground trainers and more accurate in-flight performance feedback techniques should reduce the total flight time requirement.

RECOMMENDATIONS

1. As a result of the apparent weaknesses in the experimental curriculum of this program, a new approach to VFR-IFR training is recommended, with the following objectives and functions:

   (a) To certify private pilots with instrument ratings in approximately 120 hours flight time.

   (b) Greater utilization of any one of the current procedures trainers (e.g., GAT, Frasca, Flightmatic).

   (c) The curriculum should be structured into three distinct phases of about 40 hours each.

   (d) The first phase would be comparable to current standard private pilot training but with basic instrument training increased to a minimum of 10 hours.

      (1) These 10 hours should be taught using the "block" technique of the experimental curriculum but limited to the following specific maneuvers:

         Turns and steep turns
         Approach and departure stalls
         Climbs and descents
         Slow flight
         Partial Panel
         Introduction to VOR and ADF navigation.

      (2) The emphasis in these 10 hours should be on control and understanding. Communications and procedures would be deferred.

   (e) The second phase would develop command ability through the use of extensive and carefully supervised solo cross-country flights.

      (1) This phase should require approximately 20 to 30 hours of solo cross-country, interspersed with 10 to 20 hours of dual instruction in the areas of VFR cross-country emergencies, unique landing field situations (e.g., soft and short fields), and review of basic instrument flying.

      (2) All solo cross-country flights to be used to meet the experience requirement of this phase should be reviewed by the pilot's instructor to assure that each flight offers an opportunity for new learning experiences.

(f) The third phase would be essentially the current standard instrument curriculum. Toward the end of the third phase, provisions should be made to permit the pilot to file and fly solo instrument flight under very restricted instrument conditions.

2. There should be increased use of the technique of "intellectualization;" i.e., having the student verbalize to the instructor all actions chronologically to be made on the next flight.

3. More positive and objective feedback should be given to the student, especially the instrument student, through the use of audio tape recordings.

4. An attempt should be made to better coordinate ground school instruction with flight instruction.

5. Ground school courses should consider the merits of programmed classroom instruction using a mechanical or electrical responder system.

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In addition, acknowledgement is made of the contributions of Mr. Russell Lewis and Miss Hortense McGehee both of whom served as flight instructors and ground instructors in this program.

APPENDIX A

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APPENDIX B

COMBINED VFR-IFR FLIGHT TRAINING SYLLABUS

To The Student and Instructor:

This syllabus is designed to provide you with a guide to use in pursuing an integrated IFR-VFR training program. Written assignments are included to provide background reading on specific maneuvers and related areas of flight information. The reading assignments are from The Student Pilot's Flight Manual, William K. Kershner, Iowa, 1967 edition, abbreviated in the syllabus as K.; and from the Instrument Flying Handbook published by the Federal Aviation Administration, 1966, abbreviated in the syllabus as IFH.

TRANSITION PROCEDURES (Fixed pitch propeller airplanes)

1. Level flight to climb

   a. Throttle forward to climb power setting (usually the maximum)

   b. Raise nose to climb attitude [The correct climb attitude is verified by the airspeed (A/S) reading 90 mph in a Cherokee 140]

   c. Trim and maintain heading

2. Climb to level flight

   a. Lower nose to level flight attitude

   b. As A/S approaches 110 mph throttle back (reduce power) to cruise power setting (2400 rpm)

   c. Trim

3. Level flight to power off glide

   a. Carburetor heat full on

   b. Throttle back all the way (power off condition)

   c. Hold nose in level flight attitude until A/S drops to 80 mph

   d. Lower nose so as to hold 80 mph (glide attitude)

   e. Trim

4. Glide to level flight

   a. Carburetor heat off*

   b. Throttle forward (power on) to read about 2500 rpm

   c. Raise nose to level flight attitude

   d. As A/S approaches cruise speed (110 mph) throttle back to cruise power setting (2400 rpm)

   e. Trim

---

* This is characteristic of the Cherokee 140

LEVEL FLIGHT TO POWER OFF FULL STALL PROCEDURE

1. Carburetor heat on
2. Throttle all the way back
3. Hold nose level until A/S falls to 80
4. Raise the nose to a stall attitude (important to show <u>minimum</u> pitch-up attitude)
5. Hold the nose in this attitude by bringing the wheel slowly back as far as possible
6. Hold heading
   a. Carburetor heat off*
7. When stall occurs
   a. Relax pressure on control wheel
   b. Add full power
   c. Allow nose to fall to "just below horizon" attitude
   d. Hold the nose in this attitude until A/S starts to build up
   e. Gradually raise the nose to level flight attitude
   f. When A/S reaches 75 raise nose to climb attitude
   g. Climb at A/S of 90
   h. When climb is definitely established (positive rate of climb must show on rate of climb instrument) level off

* This is a characteristic of the Cherokee 140

BASIC COMMUNICATIONS FORMAT

Pilot to Controller

CONTROLLER being called
Identification
Position
Altitude (when applicable)
Intentions

Examples:

1. On the ground, ready to taxi out
   Ohio State ground
   Cherokee 210SU
   at Transient parking
   Ready to taxi (VFR to Practice area)
   Over

2. After runup, ready for take-off
   Ohio State Tower
   Cherokee 210SU
   Ready for take-off (Runway 28 Right)
   Over

3. In the air, pilot to tower controller for landing
   Ohio State Tower
   Cherokee 210SU
   5 (miles) north
   at 2000 (feet)
   Landing OSU

Ground Controller to Pilot

Aircraft identification
Clearance to runway
Wind direction
Wind speed
Altimeter
Time
Special taxi instructions

Example:

Cherokee 210SU, east ramp
Cleared to Runway 27
Wind 290 at 20 kts
Altimeter 29.98

Tower Controller to Pilot on Ground

Aircraft identification
(Special instructions)
Take-off clearance
(Special climb instructions)

Example:

Cherokee 210SU
(Move into position and hold)
210SU cleared for take-off
(right turn out as soon as practicable)
(contact Departure Control on 120.5 for radar advisories)

PERIOD 1

INSTRUCTOR GUIDELINES

Emphasize the philosophy of instrument and visual references, the need for references, the cues available to the pilot and the general criteria that distinguishes between good and bad pilots.

Since the student's first exposure to "flying" is in the ground trainer, it is particularly important that this first exposure be well planned and executed.

Do not discuss the differences in the instruments of the ground trainer with those of the airplane. Emphasize the function of the instruments, i.e., discuss what information they present to the pilot.

Check to be sure that the unnecessary instruments are either covered up or completely ignored. Do not confuse the student with overly detailed explanations.

"Demonstration" of control usage means to show the student the rates at which the instruments should move. Control changes are effected by "pressure" application.

Trim control should always be associated with the desire to fly "hands off".

Pitch changes should be very small to properly demonstrate pitch-throttle coordination.

Adhere to the handout notes on transitions.

PERIOD 1
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0						

Introduction to the ground trainer

Philosophy of instrument and visual references
Explanation of flight controls and instruments
Explanation of engine controls and instruments
"Demonstration" of control usage and instrument responses

Student practice

For constant power:

pitch control
bank control
bank control to specific headings
pitch and bank control together

The effect of power change with wings level
The effect of trim control
The effect of rudder control on "ball and needle"

at cruise speed
at slow speed

The coordination of pitch and throttle to maintain constant airspeed

"Demonstration" of transition procedures

ASSIGNMENT:

Memorize transition procedures

Read Kershner: (K) 3-17

Instrument Flying Handbook (IFH) 92-94

PERIOD 2
QUIZ

1. For constant throttle setting, if you increase the pitch attitude by moving the control wheel back, what are the indications on (a) the instruments? (b) the visual scene?

2. If you hold the control wheel so as to keep the nose on the horizon, what indications and feelings do you observe when you (a) push the throttle forward? and (b) pull the throttle all the way back?

3. Describe the transition from power-off glide to level flight cruise.

Emphasize the bank attitude picture on the artificial horizon for the proper position of the turn rate needle.

Be sure the student verifies the airplane turns through 180° in one minute.

Use 140 for an airspeed. Call attention to the bar width displacement and rpm settings. Initial instruction is to set pitch attitude first.

Wet compass is not reliable when turning, etc. i. e. can only be calibrated when airplane is straight and level and at constant speed.

Demonstrate briefly how the compass turns the wrong way when turning from N to E or W.

Phraseology for all headings should be in terms of three distinct numbers.

On timed turns, attention to rates of roll in and roll out.

PERIOD 2
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	2.0					

Review and quiz of principles

Student practice of the transition procedures, hood on

Define and demonstrate

Standard rate turn with DG and clock
"Standard" rate climb and descent
Cruise descent

Discuss briefly wet compass limitations

Student practice with instrument hood on

Standard rate turns at level flight
Timed turns to specific headings (DG caged)
Standard climb and descent
(Note airspeed and power settings)
Cruise

ASSIGNMENT:

IFH, 9-20; 46-50

PERIOD 3
QUIZ

1. What is meant by true altitude and indicated altitude? When are they the same?

2. What instruments require a static air source?

Trainer should be set and trimmed for straight and level cruise. Transitions are to be done for a constant heading.

Progress reports on first trial only. Then student practices as necessary, but no more than three series.

Calibration problems

Given an altimeter setting which results in an indicated altitude different than field elevation, discuss the procedure for determining the altimeter error and how this known error is then used.

Given a climb configuration, offset the artificial horizon and ask the student to reset when straight and level.

Wet compass and D.G. checked when on known runway heading.

Adhere closely to phraseology and communication handout notes.

Progress reports, first trial only.

Student will repeat this period if transitions and standard rate turns do not pass the progress reports.

PERIOD 3
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	3.0					

Student practice with hood on

Transition procedures

Discuss calibration of

altimeter, artificial horizon, wet compass, directional gyro, vertical speed, airspeed

Discuss radio procedures and phraseology (use format)

Students practice with hood on

Standard rate turns (with D.G.)
Timed turns
Standard climb and descent
Cruise descent

ASSIGNMENT:

Memorize radio phraseology format

Read: K, 18-29

(Ground control and ATC procedures)

IFH, 21-31; 154-157

Note: Student must repeat Period 3 until minimum proficiency has been established

PERIOD 4
QUIZ

1. What is meant by the runway designation, "5"?

2. What are the three main types of wind indicators?

3. If the wind information is given to you as 320° at 15 knots, how would you interpret this?

Attention to student comfort and seating.

It is now appropriate to briefly discuss the differences between the ground trainer and the aircraft.

Emphasize the visual scene and references from within the cockpit. Describe those features of the aircraft that will serve as reference points in flight.

Ask the student for the aircraft's present heading.

PERIOD 4
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0					

Perform pre-flight inspection
Explain all new instruments and controls
Discuss check lists
Perform starting procedure
Perform radio check
Perform shut-down procedure
Perform tie-down procedure

Tour OSU Operations and FAA Control Tower

Review airport and runway orientation and related regulations

ASSIGNMENT:

K, 30-35

PERIOD 5
QUIZ

1. What is the normal communication sequence at a controlled airport for getting from the parking area into the air? (Need only distinguish between controller's responsibilities).

2. Define carefully the lift force on an airplane. How does angle of attack relate to this lift force?

3. You are now heading 030°. Turn to a heading of 300°. Which way are you going to turn? How many degrees are you going to turn through? How many seconds of time will it take at standard rate?

The instructor will accurately simulate ground and local controllers of a tower.

Be clear, with reasons, on how you plan to climbout and depart the area. Special attention to shallow turns to clear the nose area whenever in the climb attitude.

The alternating sequence in the syllabus of Hood On and Hood Off must be followed if the entire project is to be fairly tested.

Allow the student about 30 seconds to accommodate to the hood and the instruments. After an instruction is given allow a minimum of 15 seconds to understand and comply.

PERIOD 5
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	1.0		.5	.5	1.0

Student performs preflight, starting, and radio check

Orientation with respect to runway in use

Demonstrate throttle and brake control (discuss inertia and momentum)

Student to taxi when clear of ramp area

Perform engine run-up (with checklists)

Describe departure procedures and intentions

Pattern check and tower clearance
Line up on centerline
Perform take-off
Perform climbout (demonstrate clearing turns)

Limited orientation enroute to practice area

Hood on

Demonstrate hands-off stability and instrument responses

for straight and level
for shallow bank turn

Student practice

Straight and level flight
Standard rate turns to specific headings

Hood off

Brief visual orientation

Student practice

Straight and level flight
Standard rate turn
Medium bank turn
Medium bank turn to visual reference

Return to the airport VFR, noting landmarks, etc

Demonstrate

Radio communications
Pattern energy
Landing

Student to taxi

Instructor to park

Student to shutdown

ASSIGNMENT:

K 39-53

IFH, 32-46

PERIOD 6
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	2.0		1.0	1.0	2.0

Student performs preflight, starting and radio check
Orientation
Student to taxi, run-up and pattern check
Tower communications
Perform take-off, climbout, and level-off on 45° outbound

Hood On

Straight and level flight
Demonstrate straight climb, climbing turns and level off
Demonstrate remaining transitions
Student practices all transitions

Hood Off

Visual orientation
Student practices all transitions

Hood On

Demonstrate slow flight
Student practices slow flight

Hood Off

Orientation
Student practices slow flight

Emergency procedures (descent not below 200' AGL)
Return to airport
Perform pattern entry and landing

Memorize:

Level flight to power-off full-stall procedures

Assignment:

K 39-53
IFH, 172-178

PERIOD 7

AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	3.0		1.5	1.5	3.0

Preflight, starting, radio check, taxi, run-up
Pattern check and tower clearance
Take-off
Climbout and standard departure

Hood On

Straight and level
Transitions
Standard rate turns to headings
Timed turns
Slow flight

Student practice as necessary

Hood Off

Orientation
Straight and level
Transitions
Medium bank turns to headings
Slow Flight

Hood On

Demonstrate power stall out of slow flight
Student practice

Hood Off

Student practices power stall
Emergency procedures

Hood On

Radar vectors to airport area

Hood Off

Pattern entry
Approach to landing
Perform landing

Assignment:

K, 54-70

PERIOD 8
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	4.0		2.0	2.0	4.0

Preflight, starting, radio, taxi, run-up
Pattern check and tower clearance
Take-off
Climb-out and standard departure

Hood On

Review all maneuvers from last period
Practice as necessary

Hood Off

Orientation
Review all maneuvers from last period
Practice as necessary

Hood On

Demonstrate departure stalls
Student practice

Hood Off

Orientation
Perform departure stalls

Hood On

Demonstrate accelerated stalls
Student practice

Hood Off

Orientation
Perform accelerated stalls
Demonstrate VOR orientation
Emergency procedures
Demonstrate S-turns across a road
Return to airport
Patterr ntry
Landing

Assignment:

K 54-70
IFH, 154-157

PERIOD 9
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	5.0		2.5	2.5	5.0

Preflight, starting, radio, taxi, run-up
Pattern check and tower clearances
Take-off
Climb-out and standard departure

Hood On

Review all maneuvers to date
Practice as necessary

Hood Off

Orientation
Review all maneuvers to date
Practice as necessary
VOR orientation and tracking
Emergency procedures

Hood On

VOR interception and tracking
Return to airport via radar vectors
Surveillance approach

Hood Off

Remain in the pattern for student practice of landings and take-offs

Period 10
QUIZ

1. The pilot who has filed on IFR flight plan and accepted an ATC clearance must follow the directions contained in the clearance even if he is flying clear of clouds ar · has ground contact.

   True False

2. What is the minimum fuel requirement for an IFR flight when an alternate is required?

3. What is Z time?

Instructor will help student prepare a flight log and flight plan.

Instructor will simulate ground control, tower, and departure control.

This period may be repeated if necessary.

PERIOD 11
QUIZ

1. According to the text, where is the best place to look during a landing?

2. What is a ground loop?

3. Why are flaps used on an airplane while landing?

Student will prepare a flight log, and he will prepare and call in an IFR flight plan.

The instrument departure will be done to the point where an airway interception is made. At this point the IFR flight will be cancelled.

PERIOD 10
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	3.0	5.0		2.5	2.5	5.0

Demonstrate flight planning, filing flight plan

Hood On

Perform IFR departure, take clearances in air, and airway interception

Assignment:

K, 75-91

PERIOD 11
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	5.0		2.5	2.5	5.0

Preflight, starting, radio, taxi, runup
IFR clearance
Pattern check and tower clearance
Take-off

Hood On

Instrument departure and airway flying
Student performs ADF back to airport

Hood Off

Orientation
Traffic pattern entry
Traffic pattern
Approach and landing; remain in pattern for remainder of period for take off and landing practice

Assignment:

K, 75-91

PERIOD 12
QUIZ

1. What are the two methods of making a crosswind landing?

2. Which one is preferable?

3. Why is it preferable?

The student will prepare and file an instrument flight plan. The flight should be a destination different than the one in Period 11.

PERIOD 12
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	6.0		3.0	3.0	6.0

Flight planning for IFR flight
Preflight, starting, radio, taxi, runup
Clearance
Pattern check and tower clearance
Take-off

Hood On

Instrument departure and airway flying

Hood Off

Review of maneuvers while returning to airport
Pattern entry
Traffic pattern
Remainder of period on takeoff and landings

Assignment:

K, 75-91

PERIOD 13

Student will be given pre-solo written at beginning of this period.

The instructor will simulate radio control to include all radio calls including clearance to land. This will be done on all flights including those where no instrument training, as such, is being done.

PERIOD 13
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	7.0		3.5	3.5	7.0

Preflight
Starting
Radio communication procedures
Taxi
Run-up
Pattern check
Tower clearance

Hood Off

Take-off
Emergencies on take-off
Landings

Assignment:

K, 95-98

PERIOD 14

1. How is a cross-control stall executed?
2. How is an accelerated-turn stall done?
3. Why does the stalling speed increase in an accelerated-turn stall?

PERIOD 14
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	8.0		3.5	4.5	8.0

Preflight starting, radio, taxi, run-up
Pattern check
Take-off and landing

Pre-flight
Starting
Radio communication procedures
Taxi
Run-up
Pattern check
Tower clearance

Hood Off

Take-offs
Landings
Go-arounds

Assignment:

K, 109-116

PERIOD 15
SUPERVISED SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	8.5	0.5	3.5	5.0	9.0

Pre-flight
Starting
Radio communication procedures
Taxi
Run-up
Pattern check
Tower clearance

Hood Off

Take-off
Landings

This period may be used as a supervised solo

Assignment:

K, 139-147

PERIOD 16
SUPERVISED SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	9.0	1.0	3.5	6.5	10.0

This period may be used as a supervised solo

Assignment:

K, 139-147

PERIOD 17
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	9.5	1.5	3.5	7.5	11.0

IFR flight planning
IFR departure - cancel and return to practice area

Hood off practice

Slow flight
Stalls
Emergencies
Turns about a point

Hood on

Instructor simulates radar vectors to traffic pattern

K, 135-138

PERIOD 18
SOLO PRACTICE

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	10.5	1.5	4.0	8.0	12.0

Slow flight
Stalls

Takeoff and departure
Approach to landing

Turns about a point
Take-offs and landings

Student should remain in practice area

All stall recoveries to be completed above 1500' mean sea level

Assignments:

IFH, 141-147

PERIOD 19
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	4.0	10.5	1.5	4.0	8.0	12.0

Instructor will demonstrate ADF tracking and bearing intercepts; a number of intercepts will be done with wind put into trainer

ADF time-distance problem introduced

Assignment:

IFH, 141-147

PERIOD 20
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	5.0	10.5	1.5	4.0	8.0	12.0

Hood on

ADF Tracking
Practice as necessary

ADF Time-Distance Problem

Hood off

Student performs take-off and departure and approach-to-landing stalls

Pattern entry and landing

PERIOD 21
AIRCRAFT

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	5.0	11.5	1.5	4.6	8.9	13.0

Solo: Practice of maneuvers as directed by instructor

Slow flight
T. O. and P. stalls
Approach and landing stalls
Turns about a point
Traffic pattern
Take-off and landing

PERIOD 22
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	5.0	11.5	2.5	4.6	9.4	14.0

Student performs ADF approach under guidance of instructor and practices as necessary during the period

PERIOD 23
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	6.0	11.5	2.5	4.6	9.4	14.0

Hood Off

Take off and proceed northbound
Contact CMH approach control and request ADF approach to OSU

Hood On

Perform ADF approach to OSU

Hood Off

Short field landings and take-offs
Cross wind landings and take-offs
Soft field take-offs

Instructor Guidelines

The instructor may wish to perform this first ADF approach visual. It is recommended that after descent to minimum (or shortly after passing 3 mile fix 1B) the student should go visual to see how well he has lined up.

Emphasis is to be on holding constant headings and having the student call his new heading before he turns.

PERIOD 24
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.3	6.0	12.5	2.5	4.9	10.1	15.0

This period is to be a VFR cross-country

Flight planning reviewed (Pilotage and Dead Reckoning only)
Flight log reviewed
File flight plan with FSS

Open flight plan in flight

Short field landings at enroute airports

Close flight plan in the air (if possible)

Review all problems

Instructor Guidelines

It is recommended that this short X-C be one of the following:

OSU - Marysville - Urbana - OSU
OSU - Newark - Mt. Vernon - OSU
OSU - Marion - Marysville - OSU

The direction of flight is immaterial.

Strong emphasis on pilotage, dead reckoning, and procedures for flying into strange uncontrolled airports.

Assignment:

K, 119-134

PERIOD 25
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.2	6.0	13.8	2.5	4.9	11.4	16.3

This period is to be a VFR cross-country

Flight planning reviewed
Flight log reviewed
File flight plan with FSS
Open flight plan in flight
Short-field (and/or X-wind) landings at enroute airports

Close flight plan in the air (if possible)

Review all problems

Instructor Guidelines

With the intention that the student is to fly this X-C solo as soon as possible after this flight, the following routes are suggested:

OSU - Marion - Urbana - OSU
OSU - Mansfield - Marion - OSU
OSU - Zanesville - Mt. Vernon - OSU
OSU - Findlay - Urbana - OSU

The direction of flight is immaterial.

Pilotage and dead reckoning on at least 2 of the 3 legs.

Plan to visit the FSS and to discuss the methods used by FSS to monitor or to record flight progress. Discuss disadvantage of filing round robin and no position reports enroute.

If the FSS facility has DF equipment, attempt to get a demonstration.

If the student performs satisfactorily, he may now be signed off for solo X-C.

Assignment:

K, 135-156

PERIOD 26
AIRCRAFT SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.2	6.0	16.0	2.5	4.9	13.6	18.5

Student to fly solo the same X-C as in previous period but not necessarily the same direction

All flight planning, logs, etc. to be corrected to reflect the mistakes that may have occurred on the dual X-C

All planning to be reviewed by the instructor

Instructor will sign log book authorizing the solo X-C

Student will present flight log upon his return to his instructor

All problems reviewed

PERIOD 27
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.2	6.0	16.0	4.7	4.9	15.8	20.7

Student will plan, file and fly (Hood On) an IFR departure to Dayton; Instructor will cancel at his discretion

Hood Off

Review airwork as necessary while returning to OSU
Perform an ADF time and distance orientation to OSU

Hood On

Request and fly ADF approach to OSU

(See Instructor Guidelines for period 23)

PERIOD 28
AIRCRAFT SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	6.0	17.2	4.7	5.9	16.0	21.9

1.0 Solo Practice

Stalls, slow flight, short-field landings, turns about a point

PERIOD 29
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	6.0	17.2	5.7	5.9	17.0	22.9

Instructor will introduce VOR approaches during this ground trainer period

The VOR time distance problem will be introduced and practiced

Holding pattern entries will be demonstrated

Assignment:

IFH, 188-191

PERIOD 30
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	7.0	17.2	5.7	5.9	17.0	22.9

IFR departure from OSU. The flight plan will be cancelled at some point during the flight to allow the student to practice VOR approaches.

On the return to OSU Airport an ADF approach will be made.

Instructor Guidelines:

Student will be required to make a weather decision for this and all succeeding IFR flights.

The weather check should be made by phone to the Columbus Weather Bureau to obtain a full briefing for the flight to be made. In addition the instructor and student will examine the teletype reports available at OSU airport.

PERIOD 31
AIRCRAFT DUAL AND SOLO
1 HOUR EACH

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	7.0	18.7	5.7	7.4	17.0	24.4

One hour dual instruction. This will include IFR departure. The IFR flight plan will be cancelled and VOR approaches practiced at Appleton.
(Note: Both MFD and ZZV, simulated VOR approaches, can be done at APE.)

One hour solo practice: Student will practice all solo maneuvers as directed by instructor.

PERIOD 32
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	7.0	19.7	6.7	8.9	18.0	26.9

IFR flight on flight plan to Mansfield. A VOR approach and landing will be made and a flight plan to OSU Airport will be filed. An approach to OSU Airport will be made.

Instructor Guidelines:

A visit to the MFD FSS should be made on this flight.

PERIOD 33
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	7.0	21.2	6.7	9.9	18.0	27.9

Student will begin practice of ILS approaches in ground trainer under supervision of flight instructor.

Assignment:

IFH, 161-170

PERIOD 34
AIRCRAFT DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	21.2	6.7	9.9	18.0	27.9

IFR flight plan will be filed and the instrument departure accomplished.

The flight plan will then be cancelled and ILS approaches practiced

The return to OSU should be made with the hood off and slow flight, stalls, and short-field landings should be practiced.

PERIOD 35

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	22.7	6.7	11.4	18.0	29.9

IFR flight plan will be filed and an instrument departure done. The flight plan will then be cancelled and the remainder of the period used for practice of ILS approaches at CMH.

PERIOD 36
VFR DUAL AND SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	24.2	6.7	12.9	18.0	30.9

VFR Dual review of airwork

VFR solo practice of airwork as directed by instructor

PERIOD 37
SOLO

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	25.0	7.9	12.9	19.5	32.4

Solo practice as directed by instructor

PERIOD 38
DUAL

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	25.0	8.9	12.9	21.0	33.9

1.0 IFR flight on flight plan; two ILS approaches will be made during flight.

.5 VFR dual on airwork; steep turns, short-field and soft-field landings

PERIOD 39
SOLO PRACTICE

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	26.5	8.9	13.9	21.5	35.4

This is a long solo practice period to enable the student to practice all maneuvers required by the flight instructor.

PERIOD 40
DUAL IFR AND VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	26.5	10.4	13.9	23.0	36.9

1.0 IFR instrument flight on flight plan
2 ILS approaches will be made on this flight
.5 VFR dual practice short-field take-off and landings

PERIOD 41
SOLO X-C

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
4.5	8.5	27.5	10.9	14.9	23.5	38.4

This period is to enable the student to fly the solo cross-country requirement as required by the FAA.

The exact placement of this period in the total syllabus will be at the discretion of the instructor.

The student will prepare a flight log to be approved by the instructor. The student's log book will be taken on the flight and signed at each stop.

PERIOD 42
DUAL IFR AND VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	27.5	15.4	14.9	28.0	42.9

1.0 IFR flight on flight plan
A VOR and an ADF approach will be practiced on this flight

.5 VFR dual instruction, steep turns, stalls, slow flight

PERIOD 43
SOLO PRACTICE

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	29.0	15.4	15.9	28.5	44.4

Student will practice maneuvers as directed by instructor

PERIOD 44
DUAL IFR AND VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	29.0	16.9	15.9	30.0	45.9

1.0 IFR flight on a flight plan to an airport having an ADF or VOR instrument approach; a holding pattern will be done on this flight

0.5 VFR instruction and review
Turns about a point, short-field take-off and landings, steep turns

PERIOD 45
GROUND TRAINER

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	8.5	30.5	16.9	16.9	30.5	47.4

This period will be used to practice all holding pattern entries. Special emphasis will be placed on the teardrop and parallel entry methods.

Assignment:

IFH, 161-170

PERIOD 46
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	30.5	16.9	16.9	30.5	47.9

IFR flight on a flight plan; holding practices at airway intersections, and at VOR, and ADF stations

The three methods of holding pattern entries should be practiced during this period. The student's attention should be called to the need to report leaving the holding pattern.

PERIOD 47
SOLO PERIOD VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	32.0	16.9	18.9	30.5	48.9

Review of all stalls, turns about a point, S turns, steep turns, normal and short-field landings.

PERIOD 48
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	32.0	18.4	18.4	32.0	50.4

IFR flight on flight plan

Cancelled at APE

VOR approach at APE

ILS approach CMH, and missed approach

ADF approach OSU

PERIOD 49
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	10.0	33.5	18.4	19.9	32.0	51.9

XC flight on IFR flight plan to ZZV, MFD, OSU

VOR approach at ZZV

ILS approach MFD

ADF approach at OSU

PERIOD 50
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	10.0	35.5	18.4	21.9	32.0	53.9

XC flight on IFR flight plan to LIA, DAY, OSU

Omni approach at LIA

ILS back course at DAY

ADF approach OSU

Missed approach at LIA, and DAY

Holding at OSU RB_n

PERIOD 51
DUAL AND SOLO PERIOD VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	37.5	18.4	23.9	32.0	55.9

.5 Dual

Short-field take-off

All stalls, emergencies, short- and soft-field landings

1.0 Solo

Practice of above maneuvers with the exception of emergencies

PERIOD 52
DUAL VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	38.0	19.4	23.9	33.5	57.4

This period will be a recommendation flight for the private pilot flight check

All required items will be practiced (see FAA Publication ACA 61-3A, Flight Test Guide Airplane Single Engine)

PERIOD 53
VFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	10.0	39.5	19.9	23.9	35.0	58.9

This period will be used for the private pilot flight check

PERIOD 54
SIMULATOR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.0	11.0	41.0	19.4	23.9	36.5	60.4

This period to be used for XC flying in the simulator; the operator should simulate all ground control facilities

PERIOD 55
DUAL IFR LONG XC

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
3.0	12.0	41.0	19.4	23.9	36.5	60.4

This period will be used for the long instrument cross country to meet FAA requirements for the instrument rating

PERIOD 56
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
1.5	12.0	44.0	19.4	26.9	36.5	63.4

This period will be used as a review of the basic air work portion of the instrument rating flight test

The following will be done on partial panel:

time turns
timed climbs and descents
stalls in approach configuration
unusual attitudes

Steep turns will be practiced on full panel

PERIOD 57
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	12.0	45.4	19.4	28.4	36.5	64.9

This period will be a review of the radio navigation portion of the instrument rating flight test

ILS, VOR, and ADF approaches

Holding, and time distance problems will all be practiced; the departure portion of the flight will be on an IFR clearance

PERIOD 58
DUAL IFR

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	12.0	47.0	19.4	30.4	36.5	66.9

Review and practice in preparation for the instrument flight test

This period may be repeated as necessary until instructor can recommend student for the instrument flight test

PERIOD 60

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	12.0	51.0	19.4	34.4	36.5	72.9

Instrument flight test to complete program.

PERIOD 59

This Period	PREVIOUS TIME					
	Ground Trainer	Dual	Solo	IFR	VFR	Total
2.0	12.0	49.0	19.4	32.9	36.5	68.9

General review for instrument flight test.

APPENDIX C

FLIGHT TRAINING SYLLABUS

Stage 1: Presolo and Supervised Solo

Orientation Phase

Period 1

Discuss the forces on the airplane in flight, axis of rotation, function of controls (including trim tabs and flaps), and instruments. Demonstrate preflight checklists, starting procedures, radio check, pre-takeoff check, and orient the student to the practice areas.

Period 2

Review of Period 1. Discuss and practice pre-flight inspection, starting, radio check, pre-takeoff procedures and flight instruments. Introduce and practice straight and level flight, level turns, straight climbs, climbing turns, straight glides, gliding turns. Before returning to the airport, call University Tower (121.1) to obtain surface winds and the runway in use. Introduce and practice taxiing and the proper use of controls while taxiing.

Period 3

Discuss the principles of basic instrument flying. Demonstrate use of instruments and controls and explain function of each. Devote flight portion equally to visual and instrument flight with practice of straight and level turns.

Pre-Solo High Work Phase

Period 4

Discuss and review visually and on instruments the previous fundamentals such as straight and level and level turns and the use of the artificial horizon and directional gyro. Practice coordination exercises, steep turns, takeoff and departure stalls, approach to landing stalls, torque correction in relation to airspeed, power changes, and takeoffs. Demonstrate the use of trim tab and its function.

Period 5

Discuss torque correction and the use of trim. Review fundamentals visually and on instruments the maneuvers of Period 4.

Demonstrate spin entry from a stall and spin recovery techniques.

Period 6

Discuss local ground and air traffic patterns and rules. Introduce takeoffs. Demonstrate and practice slow flight, practice takeoff and departure stalls, approach to landing stalls, coordination exercises, and introduce power-off landing on return to the airport. On simulated instruments, practice straight and level climbing turns and gliding turns.

Period 7

Discuss air courtesy and discipline. Practice visually and on-instruments climbing and gliding turns, slow flight, and takeoff and departure stalls.

Pre-Solo Low Work Phase

Period 8

Discuss and practice takeoffs and landings, traffic patterns and traffic-pattern entry, taxi patterns, low-altitude forced landings on takeoff, forward slips, and crosswind takeoffs and landings.

Period 9

Discuss and practice power-on and power-off stalls visually and on instruments. Review straight and level and turns on simulated instruments. Demonstrate power-off spot landing.

Period 10

Discuss and practice slow flight and high-altitude emergencies. Call Columbus radio for winds aloft. Practice takeoffs and landings. Review crosswind landings and takeoffs.

Period 11

Discuss and practice traffic-pattern entry, slips, use of flaps, takeoffs and landings.

Period 12

Discuss traffic patterns and emergencies. Call Columbus radio for current Mansfield weather. Practice takeoffs and landings.

Period 13

Discuss traffic patterns and emergency procedures. Practice takeoffs and landings.

Solo Phase

Period 14

Discuss and practice takeoffs and landings including at least one emergency on takeoff and one crosswind landing. The instructor will supervise three solo takeoffs and landings. If the student is not ready to solo, this period may be repeated with practice on maneuvers either out of or in the traffic pattern on which the student may be deficient until the student is ready to solo. (First supervised solo.)

Period 15

Instructor will supervise a minimum of five solo takeoffs and full stop landings. (Second supervised solo.)

Period 16

Discuss, review, and practice crosswind takeoffs and landings, drift correction, use of flaps, and spot landings. Student will make at least four full stop landings solo. (Third supervised solo.)

Period 17

Discuss the use of radio in control of ground and air traffic. Student will practice takeoffs and landings as directed by the instructor. (Student will check radio prior to takeoff and will remain on the University frequency at all times while solo.)

Period 18

Written Stage 1 examination will be given by the instructor followed by a discussion of the results and appropriate recommendations.

Period 19

Stage check by the check pilot and discussion of student progress with appropriate recommendations.

Stage II: Pre-Cross Country

Post-Solo Proficiency Phase

Period 20

Introduce, discuss, and practice 720-degree steep turns and

recovery from power-on spirals visually and on instruments. Introduce shallow, medium, steep-banked turns to predetermined headings. Review takeoff and departure stalls, slow flight, and climbing and gliding turns.

Period 21

Introduce and discuss level standard rate turns to predetermined headings. Practice straight climbs and descents and climbing and descending turns.

Period 22

Discuss and practice visually and on-instruments recovery from spirals, slow flight, and approach to landing stalls. Review traffic pattern and takeoffs and landings.

Period 23

Instructor will brief student before takeoff. Student will leave pattern and practice takeoff and departure stalls, approach to landing stalls, 720-degree turns, slow flight, and accuracy landings. Student should check radio prior to takeoff and will remain on University frequency at all times while on local flight.

Period 24

Discuss, review, and practice all stalls, 720-degree steep turns, slow flight, and accuracy landings. Instructor should demonstrate use of omni on this flight.

Period 25

Review previous period and introduce short field and soft field takeoffs and landings.

Period 26

Discuss and practice maneuvers of Periods 24 and 25 as directed by the instructor. Simulated forced landings are strictly prohibited solo.

Period 27

Discuss and practice climbs, descents, climbing turns, and descending turns. Introduce "C" pattern in level flight. Practice turns to predetermined headings.

Period 28

Discuss and practice recovery from unusual altitudes. Practice

all variations of landings and takeoffs, soft field, short field crosswind, and full-stall landings.

Period 29

Discuss and practice maneuvers of previous periods as directed by the instructor.

Period 30

Discuss and practice "C" patterns and radio procedures.

Period 31

Give a thorough briefing on pecularities of night flying, the eye, and night vision. Student shall be made aware of good night-flying practices and precautions. Explain and demonstrate the Aldis lamp. Practice night landings.

Period 32

Written examination on State II will be given by the instructor and will be followed by a discussion of the results and appropriate recommendations.

Period 33

School check pilot. Complete proficiency check for Stage II with appropriate recommendations. Discussion follows check between check pilot, student, and instructor.

Stage III: Dual and Solo Cross-Country

Period 34

Discuss and practice at strange non-controlled and controlled airports such as Delaware, Columbus Air Park, and Port Columbus. Demonstrate and practice use of the omni. At least one landing will be made each at a controlled and non-controlled airport.

Period 35

Discuss map preparation, checking weather prior to takeoff, use of the computer, "Airmans' Information Manual," or other publications as necessary. The weather will be checked by use of teletype reports. The weather bureau will be called only if supplemental information is necessary. All landings will be made at airports served by a control tower. At least one visit should be made to control tower, weather bureau, and flight service station during the flight.

Period 36

The student should be checked on map preparation, flight-preparation knowledge of airports at which he will land, understanding of the anticipated weather he will encounter enroute plus additional forecasts and his plans in the event he becomes lost or is forced down because of weather. At least one destination should be served by a control tower. Flight should be planned over a triangular course, making full-stop landings, closing flight plan, re-filing a flight plan, and checking weather before departure on the next leg. (OSU - Dayton - Marion - OSU)

Period 37

Discuss the various aids to night navigation which shall include airway beacons, radio ranges, main highways, cities, forced landings, flare equipment, radar surveillance units, and "lost procedures." Flight experience shall include navigation by pilotage, radio range flying, and communications with a radar installation.

Period 38

Same as Period 36 except that one leg must be at least 200 miles non-stop from the University Airport. This flight will be made to Purdue University Airport, West Lafayette, Indiana and Baer Field, Ft. Wayne, Indiana.

Period 39

Give written examination of Stage III and discuss.

Period 40

School check pilot completion proficiency check for Stage I[illegible] with appropriate recommendations.

Stage IV: Preparation for Course Completion Check

Period 41

Discuss and practice all stalls, 720° turns, climbing and gliding turns, slow flight, spirals, and high-altitude forced landings. The instructor should stress good planning on all flight, i.e., logical sequence of maneuvers, remaining within specified area, etc.

Period 42

Discuss and practice climbing and gliding turns, recovery from power-on spirals, turns to predetermined headings, recovery from unusual altitudes visually and on instruments.

Period 43

Discuss and practice maneuvers of Periods 41 and 42 as directed by the instructor.

Period 44

Discuss and practice complete "C" pattern and radio procedures.

Period 45

Discuss and practice all maneuvers to date with emphasis on those outlined in the FAA private-pilot flight test guide. Pay particular attention to flight planning and the use of the radio.

Period 46

Give final written exam and discuss. Record results appropriately.

Period 47

Instructor recommendation flight. Upon completion of flight, instructor completes student file.

Period 48

Final Flight Check

CRITERION FOR SAFE SOLO CROSS-COUNTRY

The following is a list of items that should be observed before a student is declared safe for solo cross-country. Make a note of the total flight time the student has and the date you make the decision the student is ready.

1. Safe for solo - local.

2. Demonstrate ability to control the aircraft through reference to instruments only.

3. Demonstrate ability to make at least three safe crosswind landings and recover from a bounced crosswind landing; make a traffic pattern pull up and go around; and enter a strange field.

4. Demonstrate ability to make "positive" identification of ground objects and use the proper procedures in locating the next check points.

5. Demonstrate ability to navigate by pilotage:

   a. Holding heading as pre-flight planned.
   b. Make small adjustment to headings, ground speeds, and ETA's after first wind check.
   c. Maintain altitudes.
   d. Set directional gyro from magnetic compass.

6. Demonstrate ability to navigate by VHF radio aids:

   a. Intercept a radial.
   b. Track within one-half needle deflection to within three minutes of station.
   c. Track outbound (same tolerances as 5c above).

7. Be capable of locating and checking NOTAMS pertinent to his planned route.

8. Understand communications procedures and demonstrate ability to accomplish effective in-flight communications, follow control tower instructions, and be encouraged to ask for information desired without fear.

9. Be able to locate all naviagation and communications frequencies to be used on a planned cross-country flight.

10. Capable of identifying reported or observed weather conditions which would be adverse to the continued safety of that flight.

11. Understand general procedures used in emergencies such as being lost, diverting to alternate field, and engine or mechanical malfunctions.

APPENDIX D

STANDARD INSTRUMENT RATING TRAINING SYLLABUS

This syllabus is designed to develop the knowledge and skills necessary for the pilot to operate effectively and efficiently in the realm of instrument flight. The syllabus is to be used as a guide to meet the above objective; the individual instructor will gear the pace to the student's progress.

Particular emphasis will be placed on the use of the Link trainer as a supplement and aid to the in-flight instruction. In addition, emphasis is placed on the use of actual or simulated cross-country instrument flights where the student will be exposed to the total picture of instrument flight.

The course will include 35 hours of flight time coupled with 20 hours in the Link trainer. The instructional period for 600D will consist of two standard departmental flight periods in order to provide for the necessary time for pre-flight and post-flight discussions. In the weeks during which cross-country flights are to be conducted, modifications will be made in aircraft scheduling.

TIME BREAKDOWN BY WEEKS FOR 600D

Week	Dual-Simulated Instrument	Link
1	2	2
2	2	2
3	3	2
4	3	2
5	3	2
6	4	2
7	4	2
8	4	2
9	5	2
10	5	2
TOTAL	35	20

600D - 35 HOURS

1st Week (Dual 2.0; Link 2.0)

LINK: Review of basic instrument attitude flying with emphasis on proper scan techniques and limitations of various instruments. Review of flight at varying airspeeds, constant airspeed descents, and constant rate descents and climbs.

FLIGHT: Discussion of proper pre-flight techniques and pre-flight cockpit checks; student should be instructed to prepare his own IFR check list. In-flight work on basic instrument attitude flying stressing those aspects covered in the Link.

2nd Week (Dual SI 2.0; Link 2.0)

LINK: Review and practice of basic instrument skills including primary panel work with standard rate turns. Introduction of Patterns "A" and "B" (see figure, page D-5).

FLIGHT: Practice of primary panel work with timed climbing and gliding turns. Introduction of Pattersn "A" and "B." While returning to the University Airport after each flight, introduce the use of the ADF.

3rd Week (Dual 3.0; Link 2.0)

LINK: Introduction of VOR and ADF orientation including intercepts and tracking.

FLIGHT: Introduction of VOR and ADF orientation including intercepts and tracking. Introduce time and distance to station problems. Practice of ASR approaches at Port Columbus.

4th Week (Dual 3.0; Link 2.0)

LINK: Review of VOR and ADF intercepts and tracking and the introduction of VOR and ADF holding patterns.

FLIGHT: Practice ASR approaches as needed and review VOR and ADF intercepts and tracking. Introduction to VOR and ADF holding patterns and pattern entries.

5th Week (Dual 3.0; Link 2.0)

LINK: Introduction to front and back course ILS approaches and the proper use of ATC frequencies. Introduction to ADF approaches.

FLIGHT: Enroute work and holding at Appleton VOR with ILS approaches at Port Columbus and ADF approaches at OSU with appropriate intercepts and tracking problems.

6th Week (Dual 3.0; Link 2.0)

LINK: Review and practice ILS and ADF approaches. Introduction of VOR approaches and ADF - VOR intersections.

FLIGHT: Enroute work to Appleton VOR using Dublin intersection for ADF orientation; holding at Appleton with Simulated VOR approach off of Appleton. Practice ILS approaches at Port Columbus and ADF holds at OSU with ADF approaches at the University Airport.

7th Week (Dual 4.0; Link 2.0)

LINK: Review and practice ILS, VOR, and ADF approaches with emphasis on ATC procedures. Practice holding patterns at a VOR station, ADF station, and at intersections.

FLIGHT: One simulated or actual IFR flight to Zanesville using all of the available approaches if the flight is simulated, with return to Port Columbus for ILS and to the University Airport for an ADF approach.

One simulated or actual flight to Mansfield utilizing all available approaches if the flight is simulated. Return to OSU for ADF approach.

On the above flights, emphasis should be placed on pre-flight planning and knowledge of ATC procedures. In both cases, the student will file an IFR flight plan and handle the majority of the communications.

8th Week (Dual 4.0; Link 2.0)

LINK: Practice as needed with emphasis on ATC procedures and communications.

FLIGHT: Two simulated or actual cross-country flights of two hours duration each. Routes should be selected to provide the student with maximum exposure to ATC procedures and the use of estimates as well as exposing him to the three basic approaches. Holds should be requested in the flight plans if the flight is simulated.

9th Week (Dual 5.0; Link 1.0)

LINK: Practice as needed under the guidance of the student's flight instructor.

FLIGHT: Two simulated or actual cross-country flights with one of three hours duration and one of two hours duration. These flights should include exposure to all of the various facets of instrument flight as is found practical. If feasible, the instructor will discuss possible emergency situations that could be encountered on the flight.

10th Week (Dual 5.0; Link 2.0)

LINK: Review and practice as directed and supervised by the student's flight instructor.

FLIGHT: Three hours will be devoted to the necessary review and practice as needed, including primary panel work.

Two hours of this week will be set aside for the final checkride if the student qualifies in terms of knowledge and skill.

The instrument flight laboratory is accompanied by Aviation 603 which represents the classroom portion of the total course. However, considerable emphasis is placed on the use of the instructor-student relationship during the discussion periods, both of the pre-flight and post-flight nature, since the instructor is in the best position to judge the student's weaknessess.

APPENDIX E

COMBINED VFR-IFR GROUND SCHOOL SYLLABUS

Class Materials and Texts:

- Private Pilot Handbook
- Aviation Weather (AC00-6)
- F.A.R.'s (1, 61, 91)
- Exam-O-Grams (VFR and IFR)
- Local VFR and IFR Charts
- Instrument Flying Handbook (AC 61-27)

The two quarters were broken up into ten class sections of three hours each, for a total of 30 hours per quarter and 60 hours for the course.

Each class was begun with a Sanderson film strip that was either directly or closely related to the subject for that section.

The lecture was supplemented with liberal use of the transparencies covering all subject areas. The Sanderson Courses included Flight Maneuvers, Private, and Instrument Courses.

GROUND SCHOOL, VFR - IFR
FIRST QUARTER

SECTION	SUBJECT
#1	Review of Prior Areas

- Forces Acting on Aircraft
- Airfoils
- Relative Wind
- Angle of Attack
- Bernoullis Principle
- Factors Affecting Lift and Drag
- Types of Drag
- Function of Controls and Description of Axis

#2 Flight Instruments and Systems

- Pitot-Static System
- Altimeter
- Types of Altitudes (True etc.)
- Airspeed
- Types of Airspeeds
- Vertical Speed Indicator
- Turn and Bank
- Gyro Compass
- Artifical Horizon
- Magnetic Compass and Errors
- Use and Interpretation of Flight Instruments (climbs - turns - descents, etc.)

#3 Introduction to ATC System and Federal Aviation Regulations

- Flight Service Station
- Local VFR Control
- Local IFR Control
- Air Traffic Control Centers
- F.A.R. #1, 6., 91 (VFR only)

#4 VOR Navigation and Enroute Charts

- Explanation of VOR System
- Cockpit Presentations
- Intercepting and Tracking
- Reverse Sensing
- VOR vs VORTAC
- Legend to Enroute Chart
- Definitions (MEA, MCA, etc.)

SECTION	SUBJECT

#5 Flight Planning and Departure Procedures

- The Flight Plan
- Selecting Route of Flight
- Taking the Clearance
- Transfer of Control and use of Departure Control
- Simulated IFR Departure with XC

#6 ADF Usage and Midterm

- Relationship and Differences with VOR usage
- Difference between Homing and Tracking
- Difference of Relative Bearing
- ADF Formula (MH + RB = MB)
- Intercepting and Tracking
- Orientation and Fixes

#7 Introduction to Weather

- Use of (12 hour) Terminal Forecast
- Use of Area Forecast
- Use of Winds Aloft Forecast
- SIGMETS
- AIRMETS
- The Sequence Report
  - Order of items
  - Symbols and Codes
  - Reading the Report with practice reports

#8 Review of Weather - Use of E6B

- Practice Interpretation of Forecasts and sequence reports
- Computer side of E6B
  - Time, Distance and Speed
  - Conversion Scales
  - True Airspeed
  - Fuel Consumption
  - Density Altitude
- Practice Problems

#9 Elements of Navigation

- Definitions (TC, TH, MH, CH, MC, CC, variation, deviation, IAS vs TAS, heading vs course.)
- Use of plotter and sectional chart
- Working from Chart to Compass Heading and from CH to Chart
- The Wind Triangle
- Use of Wind Side of E6B
- Practice Problem

SECTION	SUBJECT
#10	Review of Navigation and F.A.R.'s

- Practice Problems using wind triangle and E6B
- Class questions or Navigation
- Class questions and discussion of F.A.R.'s (VFR only)

* Final Exam was given on an individual basis.

GROUND SCHOOL VFR - IFR
SECOND QUARTER

SECTION	SUBJECT
#1	Review of Prior Areas

- VFR Navigation and F.A.R.'s
- Weight and Balance Calculations
- Use of Performance Charts
- Basic Weather Problems

#2 Instrument Flight Rules

- Discussion of:
  - Part #1 - Definitions
  - Part #61 - Certificates
  - Part #91 - General and IFR Rules

#3 Instrument Flight Charts

- Area Departure
- Standard Instrument Departures
- Review of Enroute Charts
- Area Arrival
- Approach Plates (Standard)

#4 ADF Procedures and Approaches

- Review of ADF Terms
- Intercepting and Tracking
- Identifying (ADF-VOR) Intersections
- ADF Time and Distance Problems
- The Approach

#5 VOR and ILS Procedures and Approaches

- Review of VOR Usage
- VOR intersections
- VOR Time and Distance Problems
- The VOR Approach
- Components of ILS System
  - Localizer
  - Glide Slope
  - Markers (OM and MM)
  - Locators
  - Approach lights
- Characteristics of ILS Approach
- Practical Problems
- Back Course

SECTION	SUBJECT
#6	Additional Procedures and Approaches - Holding Procedures (VOR and ADF) - Radar Beacon System - Precision and Surveillance Radar - Change Over Points - Climb and Descent Restrictions - Use of ATIS - Speed limits and adjustments - Required reports on IFR Flight - Communication Failure - Radar Beacon Codes
#7	Air Traffic Control This class was lecture followed by question and answer period conducted by a local Air Traffic Control Specialist. It was an in depth look at controller-pilot-system problems.
#8	Review of Weather Reports and Introduction to Advanced Weather Analysis - Sequence reports, terminal forecasts, area forecasts, winds aloft - Types and characteristics of cloud formations (cirrus, stratus, etc.) - Classification and characteristics of Air Masses (Warm, Cold, Polar, Maritime, etc.) - Depiction of air masses on surface charts - Flight conditions and problems associated with warm and cold air masses.
#9	Advanced Weather - Formation of frontal systems - Description of all types of fronts - Characteristics and flight probelms related to all fronts - Use of daily surface chart (Station model) - Types of ice and influence on aircraft (rime, clear, etc.) - Types of fog (advection, radiation, etc.) - Thunderstorms - Changes in weather when flying through a front

SECTION	SUBJECT
#10	New TERPS and Approach Plates - New definitions (DH, MDA, HAA, HAT, etc.) - New regulations (alternate minimums, visibility requirements, etc.) - Explanation of new format and comparison to the standard plate with emphasis on changes. - Question and answer on any part of the course.

* Final exam given on an individual basis.

APPENDIX F

FLIGHT CHECK PROFILES

Stage I - Experimental Group (E)

Preflight procedures
Taxi and runup
Takeoff normal
Straight and level and turns (IFR-VFR)
Altitude transitions (IFR-VFR)
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Emergencies
Steep turns

Stage II - Experimental Group (E)

Preflight maneuvers
Taxi and runup
Takeoff normal
Straight and level and turns (IFR-VFR)
Altitude transitions (IFR-VFR)
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Emergencies
Steep turns (IFR-VFR)
Normal landings
Omni tracking
ADF tracking
Partial panel

Stage III - Experimental Group (E)

Preflight procedures
Taxi and runup
IFR clearances
Takeoff normal
Straight and level and turns (IFR-VFR)
Altitude transitions (IFR-VFR)
Steep turns (IFR-VFR)
Omni tracking
ADF tracking
ADF approaches
VOR approaches
Partial panel

Private Pilot Test, Experimental Group (E)

Preflight proceaures
Taxi and runup
Takeoff normal
Straight and leval and turns
Altitude transitions
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Acelerated stall
Emergencies
Steep turns
Normal landings
Short field landings

Instrument Flight Test, Experimental Group (E)

This consisted of the practical part of the ATR flight test. The tests were given by FAA representatives.

Stage I - Control Group (C)

Flight procedures
Taxi and runup
Takeoff normal
Straight and level and turns
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Emergencies
Normal landings

Stage II - Control Group (C)

Preflight procedures
Taxi and runup
IFR clearances
Takeoff normal
Straight and level and turns
Altitude transitions
Steep turns
Omni tracking
ADF tracking
ADF approaches
ILS approaches

Stage III - Control Group (C)

Preflight procedures
Taxi and runup
IFR clearances
Takeoff normal
Straight and level and turns
Altitude transitions
Steep turns IFR
Omni tracking
ADF tracking
VOR tracking
ILS tracking'
Partial panel

Final Check Flight, Control Group (C)

Preflight procedures
Taxi and runup
IFR clearances
Straight and leval and turns
Altitude transitions
Steep turns
Omni tracking
Omni approaches
ADF tracking
ADF approaches
ILS approaches
Holding patterns
Partial panel

Stage I - Primary Group (P)

Preflight procedures
Taxi and runup
Takeoff normal
Straight and level
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Emergencies
Normal landing

Stage II - Primary Group (P)

Preflight procedures
Taxi and runup
Takeoff normal
Straight and level and turns
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Emergencies
Normal landings
Comparison maneuvers
Preflight procedures
Taxi and runup
Takeoff normal
Straight and level and turns
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall

Private Pilot Test, Primary Group (P)

Preflight procedures
Taxi and runup
Takeoff normal
Straight and level and turns
Altitude transitions
Slow flight
Traffic patterns
Approach to landing stall
Takeoff and departure stall
Accelerated stall
Emergencies
Steep turns
Normal landings
Short field landings

APPENDIX G

PILOT PERFORMANCE DESCRIPTION RECORD

Student:_____ Instructor:_____

Check Pilot:_____ Type Check:_____

Date:_____ Period No.:_____

Aircraft No.:_____ Hrs. Dual_____ Solo_____

Weather At beginning of flights:		At end of flight: ___Unchanged, or
Wind	___Headwind ___Slight crosswind ___Direct crosswind	___ ___ ___
Velocity	___Under 10 kts. ___10 - 15 kts. ___Over 15 kts.	___ ___ ___
Turbulence	___Calm ___Moderate ___Rough	___ ___ ___
Pattern traffic	___None ___1 - 3 planes ___More than 3	___ ___ ___
Runways used	_____	_____
Students Reactions	___Normal ___Nervous	___ ___
Other	_____	_____

PREFLIGHT

Key, magnetos and control lock check:

First thing Later Never

Walk around:	Proper	Sloppy	Forgot
Oil	☐	☐	☐
Gas Drain	☐	☐	☐
Hydraulic fluid	☐	☐	☐
Tires and brakes	☐	☐	☐
Aileron hinges	☐	☐	☐
Elevator hinges	☐	☐	☐
Rudder hinges	☐	☐	☐
Static airport	☐	☐	☐
Metal work	☐	☐	☐
Windshield	☐	☐	☐

COCKPIT PROCEDURES

Minor Errors O.K. Major Errors

RADIO PROCEDURES

Minor Errors O.K. Major Errors

TAXI PROCEDURES

Clearance from objects
too close O.K. Exaggerated

Taxi Speed
Slow O.K. fast

Use of brakes
improper insufficient O.K. too much

RUNUP PROCEDURES

Check list followed_____ Checklist ignored_____

Minor Errors O.K. Major Errors

Clearing the traffic pattern before T.O.

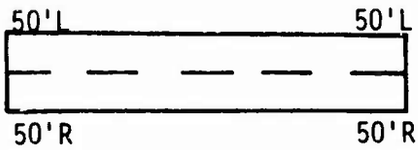
No turns_____ left turns_____ right turn_____

part way_____ full 360°_____

TAKE OFF

Normal X-Wind Short field Soft field

T.O. ROLL



Lift-off (or rotation) speed

50 55 60 65 70 75 80 85 90 95

Torque correction

rudder aileron

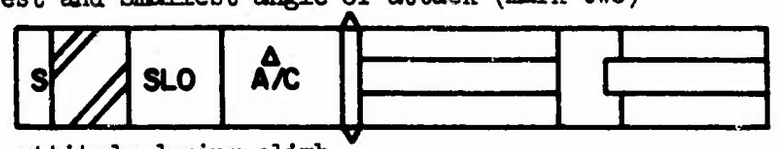
Runway alignment during climb

Left 0 Right

Lowest and Highest climb speed (mark two)

70 75 80 85 90 95 100 105 110 115

Greatest and Smallest angle of attack (mark two)



Pitch attitude during climb

too high constant too low hunting: little / a lot

Check for traffic

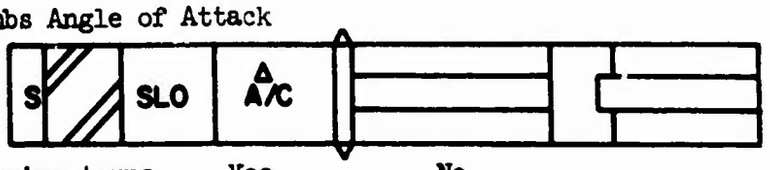
before turn during turn after turn

Traffic pattern exit correct incorrect

Climbs Airspeed

70 75 80 85 90 95 100 105 110 115 Variable

Climbs Angle of Attack



Clearing turns Yes_____ No_____

TRANSITION TO LEVEL FLIGHT

Power: correct_____ incorrect_____

Trim and altitude: correct_____ incorrect_____

STRAIGHT AND LEVEL FLIGHT

Altitude 200
100
0
100
200

Coordination: skid O.K. slip

Heading: 20° 10° 5° 0 5° 10° 20° R

Trim control: Holding back 0 forward Pressure

LEVEL FLIGHT TURNS (minimum 180°)

Altitude 200
100
0
100
200

Coordination: skid O.K. slip

Heading Error Recovery

20° 10° 5° 0 5° 10° 20° R

CLIMBING AND DESCENDING TURNS

Power change: too soon proper too late

Airspeed requested_____

Airspeed maintained:

too slow proper too high variable

Heading after roll out:

20L 10L 0 10R 20R

Use of trim

heading back 0 forward pressure

Bank control

Coordination

SLOW FLIGHT AT MINIMUM CONTROLLABLE AIRSPEED

Transition into slow flight:

Throttle and pitch coordination: proper improper

Altitude change: -200 -100 0 100 200

Heading change: - 30° - 20° 0° 10° 20° 30°

Torque control: proper improper

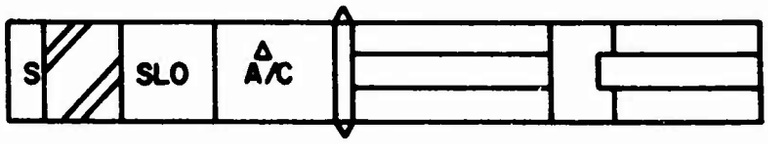
Airspeed:

50 55 60 65 70 75 80 85 90 Variable

Airplane actually stalled at:

40 45 50 55 60

Angle of Attack:



Transition out of slow flight:

Throttle and pitch coordination: proper improper

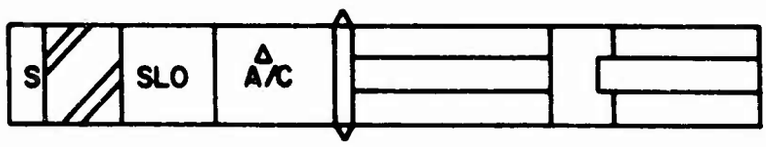
Altitude change: -200 -100 -50 0 50 100 200

Heading change: - 30° - 20° -10° 0° 20° 30°

Airspeed:

70 75 80 85 90 95 100 105 110 115 120

Angle of Attack:



STALLS - DEPARTURE

Clearing turns: No Yes 2-90°'s 1-180°

Entry rate: slow proper fast

Torque control during entry: proper improper

Coordination: skid OK slip

Bank angle: shallow medium steep variable

Altitude change in the recovery:

200
100
50
0
50
100
200

Heading change:

10° 20° 30° 40° 50° 60° 70° 80° 90°

Pitch attitude at recovery:

early proper late

Throttle control recovery:

early proper late

Carburetor heat control on recovery:

early proper late

Rudder usage in recovery:

too little proper too much

STALLS - APPROACH

Clearing turns: No Yes 2-90°'s 1-180°

Entry rate: slow proper fast

Torque control during entry: proper improper

Coordination: skid OK slip

Bank angle: shallow medium steep variable

Altitude change in the recovery:

200
100
50
0
50
100
200

Heading change:

10° 20° 30° 40° 50° 60° 70° 80° 90°

Pitch attitude at recovery: low proper high

Throttle control recovery:

early proper late

Carburetor heat control on recovery:

early proper late

Rudder usage in recovery:

too little proper too much

STALLS - ACCELERATION

Clearing turns: No Yes 2-90°'s 1-180°

Entry rate: slow proper fast

Torque control during entry proper improper

Coordination: skid OK slip

Bank angle: shallow medium steep variable

Altitude change in the recovery:

200
100
50
0
100
200

Heading change:

10° 20° 30° 40° 50° 60° 70° 80° 90°

Pitch attitude at recovery: low proper high

Throttle control on recovery:

early proper late

Carburetor heat control on recovery:

early proper late

Rudder usage in recovery:

too little proper too much

PARTIAL PANEL

Heading:	30L	20L	10L	0	10R	20R	30R
Altitude	150 100 50 0 50 100 200						

Bank Control

Coordination

Roll out on heading (time turns)

too soon OK too late

UNUSUAL ATTITUDE PARTIAL PANEL

Recovery:	late	prompt
Use of throttle	late	prompt

Coordination:

STEEP TURNS

Angle of bank:		40	50	60	Variable
Airspeed:	110	100	90	80	Variable
Altitude	150 100 50 0 50 100 150				

Coordination

OMNI TRACKING (AIRWAYS FLYING)

Radio tuning and identification: good poor

Altitude 100
50
0
50
100

Heading Control: good poor

Bracketing: good poor

VOR APPROACHES

Radio tuning and identification: poor good

Tracking and Procedure turn _____ . _____

Airspeed requested _____

Minimum Altitude 100
50
0
50
100

Missed approach: proper improper

Voice procedures: complete incomplete

ILS APPROACHES

Radio tuning and identification: poor good

Tracking procedures localizer and procedure turn:

OM	MM
0	0

Tracking procedures glide slope

Airspeed requested_____

Airspeed control: +10 +5 0 -5 -10

Minimum Altitude 100
50
0
50
100

Missed approach: proper improper

Voice procedures

HOLDING PATTERN

Entry: Correct Incorrect

Airspeed requested_____

Airspeed control: +10 +5 0 -5 -10

Altitude 100
50
0
50
100

Bank Control

Coordination

Position report: yes no

ADF TRACKING

Radio tuning and identification: good poor

Determination of heading for intercept: good poor

Establishing wind correction angle: good poor

Altitude 100
50
0
50
100

Heading control:

10L 5L 0 5R 10R

ADF APPROACHES

Radio tuning and identification: poor good

Tracking and procedure turn

_____.

Airspeed requested_____

Airspeed control +10 +5 0 -5 -10

Minimum Altitude 100
50
0
50
100

Missed approach: proper improper

Voice procedures: complete incomplete

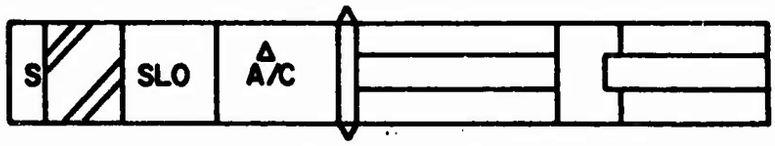
EMERGENCIES

High Altitude

Low Altitude

Airspeed: 70 75 80 85 90 95 100 105 110

Angle of Attack:



Selection of field: Proper Improper

A/C procedures: Proper Improper

Make the field: Yes No

DOWNWIND

Altitude:

200
100
50
0
50
100
200

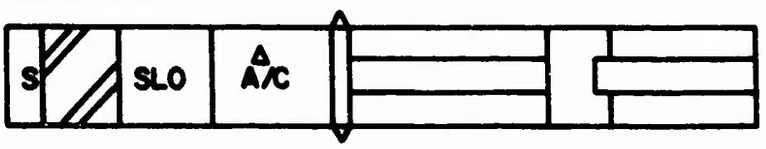
Heading:

20° 10° 5° 0 5° 10° 20° Variable

Airspeed:

75 80 85 90 95 100 105 110

Angle of Attack:



Carburetor Heat and Power Reduction

	Early	OK	Late
Flaps:	1	2	3

TURN TO BASE AND BASE LEG

Indicated Altitude when turning on to base leg.

1400 1500 1600 1700 1800

Bank angle in this turn :

shallow medium steep

Coordination of the turn: skid OK slip

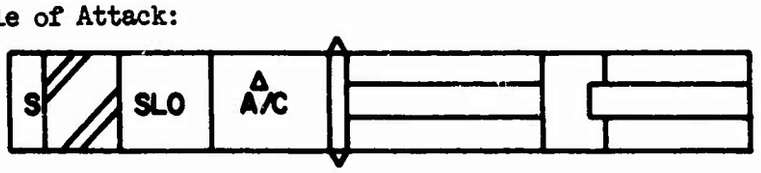
Heading:

-20° -10° -5° 0° 5° 10° 20° Variable

Airspeed on base leg.

65 70 75 80 85 90 95 100

Angle of Attack:



Pitch attitude: shallow steep

constant variable

Clearing of traffic: Yes No

Flaps: 1 2 3

TURN TO FINAL

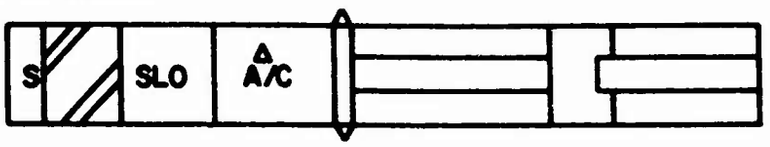
Timing: too soon OK too late

Coordination: skid OK slip

Clearing of traffic: yes no

A/S in turn: 60 65 70 75 80 85 90

Angle of Attack:



FINAL APPROACH COURSE

Type of landing: Normal X-Wind Short field Soft field

Alignment with runway: Left 0 Right

Pitch Attitude: shallow steep

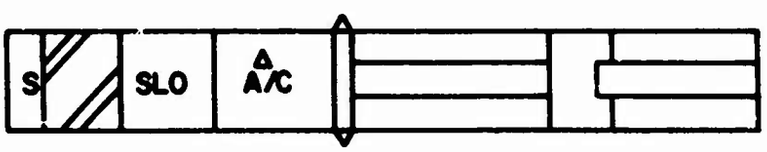
constant variable

X-Wind Correction: inadequate proper too much

Throttle control: too little 0 too much both

Airspeed: 60 65 70 75 80 85 90 95 Variable

Angle of Attack:



Flaps: 1 2 3

FLARE TO LANDING

Altitude: Low O High

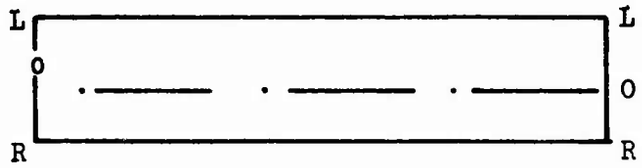
Runway alignment: Left O Right

TOUCH DOWN

Pitch attitude: Low O High V C

Impact: Light Medium Hard Bounce

ROLL OUT



APPENDIX H

SELECTED STUDENT COMMENTS

1. At the successful completion of the program, do you feel competent to fly an aircraft on actual instruments?

E 01 Yes

E 02 Yes, although more exposure to the system would definitely improve my present level.

E 03 I would be reluctant to fly an aircraft alone on actual instruments. I feel that I have the necessary knowledge and skills to conduct such a flight, but my habits would need to be developed more thoroughly before I would want to be alone. I feel the necessary habits and confidence will come with further exposure to flight.

E 04 Yes, I could fly on actual instruments; but not with the proficiency level necessary to obtain rating.

E 07 I don't think I could fly with exact precision, but I do think I could handle a plane on an instrument flight well enough to land and follow ATC procedure.

E 09 I did not complete the program successfully, but I feel that with the exception of holding patterns, I could fly an aircraft on instruments. I always have more trouble functioning correctly in a test situation than in actual condition of use. It is as though my fear of making a mistake causes me to make all the more mistakes.

E 11 I can honestly say that I do feel qualified and competent to fly an aircraft under actual instrument conditions. At the completion of the program I know that I felt mechanically able to handle all the necessary maneuvers and techniques, and, fortunately, had been able to experience actual instrument conditions once during my training. Since that time I have operated in actual instrument conditions with an instructor and have no reason to feel that I couldn't handle myself capably in the Air Traffic Control System.

E 14 I feel at this point to turn us loose in the system would be a mistake, but I believe that if I had to, I could handle the aircraft on actual instruments.

E 15 Yes, with one exception - I have not had enough experience yet to feel at ease near airports with heavy traffic, where FAA controllers are constantly relaying instructions, changes in instructions, etc.,

to a number of aircraft. I tend to "tense up," fear that I will not execute a clearance or revised clearance properly, etc. At one point (10 or 15 instrument hours back) I would become disoriented, not hear my aircraft identification when called, etc. I still have some difficulty with this, but I feel that with more experience this will improve.

E 16 No, but I would not be fearful in an IFR situation with help from ATC.

2. Do you feel additional exposure to VFR flight is necessary to help you achieve skills that are essential to instrument flight?

E 01 Not essential, but additional exposure would be highly desirable.

E 02 No, the VFR portion can only contribute so much to the IFR level. A higher level program will be more successful if additional IFR flight out of the local area were maintained.

E 03 No, although more exposure to VFR flight is always helpful in gaining experience in control of the aircraft.

E 04 VFR flight will help some, but as far as operating in the IFR system is concerned, I can see <u>no</u> substitute for filing and flying IFR.

E 06 Yes, I feel that I could use practice with holding and ADF. I think that I know and understand these procedures but that I need more experience with them.

E 07 Yes, my main problem was maintaining altitude and direction properly on things such as VOR headings. I feel that this comes with time. When I look away from the panel to read an approach I start turning also. I feel this will be corrected with time.

E 09 In my case I feel that further lessons are needed in holding patterns. In other aspects further exposure is needed to improve and maintain my level of proficiency.

E 11 I don't really feel that additional exposure to strictly VFR flight would be of any great additional benefit insofar as my operation under IFR. Perhaps for one who finds radio communications difficult, VFR flight into controlled airports would greatly ease the burden of all the radio work under IFR. I'm positive that one should maintain a high degree of proficiency under VFR to aid in the mechanics of IFR and would like to see some enforceable currency requirement for IFR flight to ensure safe operations.

E 14 Yes, I feel that I have not enough solo time to be able to think for myself and make the quick and accurate decisions that are necessary in IFR flying.

E 15 Yes, definitely. A part of my problem, as described in #1 above, is I believe, due to the combined effect of only recent familiarity with airplane operation and pilotage, and IFR instrumentation, procedures, and experience. A student, my age at any rate, reaches plateaus, then with experience moves on to the next plateau. At first, in the combined VFR-IFR program, I could not fly visually. I would "fixate" on the instruments. This could only be overcome by VFR experience. My instructor had to cover the instruments on several occasions to force me to fly VFR. For me VFR flying is a very pleasant experience and needs to be emphasized from plateau to plateau in the IFR training. VFR flying helps you build confidence in your ability to handle the airplane as you naturally gain experience simultaneously.

E 16 Yes, because (1) more VFR cross-country would give me added confidence; (2) I would be able to practice IFR skills, such as holding altitude, using the computer, flying the airways, tracking with the ADF, etc.; and (3) VFR solo cross-country would aid me in becoming more proficient in using the ATC system.

3. Do you feel that early introduction to instrument flight aided or retarded your progress? Explain.

E 01 Aided progress. Provided a better understanding of aircraft operation and performance, and developed a flight technique when learning was easier.

E 02 This added to my progress in a way which made me conquer the VFR level early and then expanded on this level with a much greater understanding as the program moved ahead.

E 03 I feel that an early introduction to instrument work was a definite asset to my progress. A good basic knowledge of instrument control of an aircraft helps tremendously in building pilot confidence. A major portion of a flight training program is a matter of repeated practice, and the more things that can be included in this practice work, the more a student pilot will gain from it. The various elements of flight control need to be studied step by step, of course, but the sooner these steps can be brought together, the sooner the student will become a well-rounded pilot. Many of the problems studied in an instrument course are very applicable to a VFR flight and as such I feel that it is not at all detrimental to include these problems in a VFR course, in the form of an IFR-VFR course.

E 04 No opinion either way!

E 06 I feel that with a fuller explanation of the instruments and their workings and a demonstration of the operating limitations of the aircraft at the beginning of the course, the course would have been ideal. Because I had to learn these things through experience, my progress was slowed.

E 07 I think early instrument helped me by making me fly with more precision and also to rely on the instruments in cases of emergency.

E 09 I feel that it aided my progress because I gained a more thorough knowledge of the controls of an aircraft and their relationships to the flight path. One disadvantage is that on VFR I had a tendency, which I have since overcome, to fly with my head in the cockpit too much. I tended to rely on my instruments too much. I tried to combat this by flying all but one of my solo cross-countries by pilotage. All in all, I feel that my VFR performance is better than it would have been had I taken the primary course. I also feel that I will, at the equivalent hours, be at least as good an IFR pilot as one taking the conventional course.

E 11 In fact, the early introduction to instrument flight both aided and retarded my progress. I think that the pre-solo hours should have had a lesser emphasis on instrument flight as I'm sure this retarded my early progress. The newness and unknown factors of those first few hours are challenge enough without having all the basics of instrument flight thrown in. I found myself thinking more about that first solo flight than the early instrument ideas. Once past the solo stage, however, I'm sure the instrument flight training helped me greatly and I feel that I'm a better Private Pilot as a result. Techniques such as scanning and cross checking visual attitudes with instruments have made me a smoother and safer pilot. Being more aware of instrument flight than other Private Pilots, I have a greater respect for IFR conditions and would like to see the instrument training requirements for Private Pilots increased, if only slightly, in order to increase the average Private Pilot's capability for and respect for IFR operations.

E 14 I feel it has aided my progress and that after I get more solo time I don't think I will have too much of a problem with my Instrument Rating.

E 15 It helped me. While I caused some consternation on the part of my instructors when first flying VFR, shooting landings, etc., I feel that I "got on top of" my VFR proficiency sooner, and am a better pilot now at 120 hours, than I would have been without early instrument flight. I hope this is not false confidence; in fact, I believe another hour or two in the Link working holding problems, tracking problems, etc., would have helped me even more.

E 16 I feel that it may have retarded my progress in that flying instruments made me over-control in VFR flight, however, this might have been a personal flaw. Also during VFR flight I tend to watch the instruments instead of looking out the cockpit, which I feel is a direct result of early IFR flight.

4. Has your desire to work toward an instrument rating been intensified or reduced? Explain.

E 01 Intensified. Knowledge and some experience in IFR flight seems to increase the desire to excel in this aspect.

E 02 If the FAA had made a positive statement earlier, the desire would have been much more intensified, but the lack of what the actual intentions were, was a stagnation in the program. I hope to continue and attain an instrument rating.

E 03 The IFR-VFR program has definitely increased my drive to obtain an instrument rating. By exposure to the problems involved in instrument flight I have come to realize the importance for any pilot to have the knowledge and skill to conduct an instrument flight, even if this were only used to meet an emergency. And as I mentioned earlier, a pilot with an instrument rating is probably a better VFR pilot than he was before he had the knowledge and skill needed for the rating.

E 04 Intensified. I think I can become an IFR pilot with additional work and this represents a goal to be achieved.

E 06 My desire for an instrument rating has been intensified. I now know that it is within my capabilities, it is not difficult, and it is enjoyable.

E 07 I am really looking forward to getting an instrument rating because I think it is more fun and interesting than VFR.

E 09 It has been intensified because it has become a challenge and I want to prove to people that I am capable of turning in a better than average performance in spite of all indications.

E 11 I'm sure that my own desire to work toward an instrument rating has been intensified by my training. I'm fascinated by the operations of the Air Traffic Control System and can imagine nothing more rewarding than operating proficiently in the complex and demanding realm of IFR flight. I couldn't say, however, that I would recommend lowering the requirements for an instrument rating any lower than 100 or 120 hours. I feel that this extra time is needed by the average pilot to attain enough VFR and IFR confidence and competence to safely operate under actual IFR.

E 14 In my case I have always planned to go on and get my instrument rating for as you know I am an airline employee and plan to fly for them, but I think this course has helped me a great deal to understand the difference between IFR and VFR flight and inspired me to want this instrument rating even more, for in my opinion, this is the only way to fly.

E 15 Intensified: I know how important instrument proficiency is becoming with more air traffic, more sophisticated aircraft, etc. I also appreciate the flexibility it allows and time is money. I want to move on and complete the training soon.

E 16 My desire to work toward an instrument rating has very definitely been intensified because of my early exposure to IFR flight. I have much more insight into IFR flight than the average pilot with my equivalent flight time and therefore know where I'm weak when it comes time for me to get an instrument rating. With this IFR exposure I have developed a liking for flying the plane by instrument and also what is involved during IFR.

APPENDIX I

SELECTED INSTRUCTOR COMMENTS

1. What changes would you suggest in the IFR-VFR program to help achieve private and instrument proficiency in 80 flight hours?

FI_1 I feel that the only change would be in the curriculum design and syllabus. It appears that there is more to be gained in the long run by stressing the VFR operations to a greater degree early in the training and allowing for more VFR solo time. This is a question of balance only, and not of basic content.

FI_2 (a) Change syllabus to give longer periods of IFR and VFR work instead of alternating IFR-VFR.
(b) Introduce VFR maneuvers first.
(c) Less instrument work early, then private at 45 hours. Give last 35 hours as if straight instrument.
(d) More simulator time that students actually received.

FI_4 Basically, I believe very little should be done to the IFR-VFR program. As it stands, the curriculum met all standards needed to prepare an individual for a private pilot license and instrument rating. Administration and organization were good. Personally, I believe more emphasis should be placed on VFR maneuvers for the first 15-18 hours. Integrated instrument training is an excellent method for developing smooth and confident handling of an aircraft; however, I believe by placing more emphasis on the VFR portion of the program the student would be learning to "walk before he runs." Being able to visualize maneuvers will, in my opinion, accelerate the student's adaptation to instrument flight, even later on in the curriculum, filing IFR cross-countries and on approaches and so on, usually in order to form a mental picture for the student.
One factor which I believe should be mentioned is the lack of motivation on the part of some students toward the IFR portion of the curriculum. Their reason in most cases was due to the fact that at the end of 80 hours they WOULD NOT attain an instrument rating regardless of proficiency. Some allowance in future programs might be considered. Furthermore, I believe some form of screening should be initiated so that at the end of a specified time students who either lack the skill or motivation for such a course could be allowed to aim toward different objectives. Lastly, there should be some sort of defined, segmented break-down based on proficiency rather than hours of exposure. In other words the first segment of the course would list:

STALLS
TURNS
EMERGENCIES

SLOW FLIGHT
TAKE-OFFS
LANDINGS
OMNI ORIENTATION
ADF ORIENTATION, etc.

This way an instructor would know at a glance what should be covered and attained by the student before going on to more advanced procedures. The final break-down would include all maneuvers required in the FAA Instrument Check Ride Booklet.

FI_5 The program is thorough and effective. The problem in achieving this goal lies mainly in the goals of the student; he wants a private license and is fully aware that he will not receive an instrument rating. He tries, but not as hard as he would if one relied upon the other (no instrument - no private). I think it can be done with this program with the proper attitude of the student. No changes.

2. What is your opinion of an 80-hour private pilot with instrument rating flying in actual conditions considering the present state of the art?

FI_1 Although the question of using flight time as a gauge of ability to perform is highly debatable, it still remains as the best means we have at present to obtain an approximate measure of skill or level of performance. Having attempted throughout the project to be open-minded on this point I do find certain traits appearing in all of the private/instrument students. The trait that stands out while operating in the system as it now functions is the consistent inability of the "80-hour" student to adjust to "abnormal" conditions that he may be confronted with. This would be such items as clearance changes, loss of some radio availability, turbulence, or any item that taxes his ability to fly the aircraft and to operate in the system all at once. In short, he possesses the pure motor skills but lacks the backlog of experience and exposure to perform effectively as a command pilot under actual IFR conditions.

FI_2 The 80-hour pilot doesn't have the exposure to flight situations generally to operate in the system as it now exists. The students do quite well until the system "breaks down" and they have to do something that isn't routine.

FI_4 I personally would not want to be operating in the same ATC system in "hard core" IFR conditions with an 80-hour instrument pilot. It has been my experience to observe professional pilots with

thousands of hours of flight time, encounter difficulty with the ATC system when minor problems occurred. I am afraid to think what would happen to an 80-hour instrument pilot were similar circumstances to occur to him. Furthermore, I question the ability of the 80-hour instrument private pilot to maintain a safe and smooth currency over a period of time. Also to keep up with the everyday changes in procedures and so on with the system, is a full-time job for the professional pilot, let alone the private pilot.

FI_5 I don't want to work in the same system under actual conditions with persons with this type of experience. A flight check is only a flight check and not all variations or unusual situations can be incorporated in it. The 80-hour pilot doesn't have enough experience to fall back on when he arrives in a situation which is entirely unexpected by him and only an above average individual might keep out of trouble.

3. Do you believe that in an intensive primary and instrument program, an "average" student can achieve an instrument rating in 80 hours? Elaborate.

FI_1 No. Instrument training can be accomplished with the above average student but with a prior definition of instrument rating. If the motor skills of instrument flying are the only considerations, then the above average student could indeed acquire the rating within the 80 hours. If you consider not only the motor skills but also a reasonable experience background for decision-making purposes the answer is "No." The low-time pilot operating in the system tends to be a very inflexible creature, especially when faced with the decision-making process relative to new and different environmental problems.

FI_2 No. Although students know what to do, they seem to be unable to do it all at once. They are overloadeddin the cockpit and often their entire performance goes to pieces when one additional responsibility is given them. They are inconsistent from day to day--sometimes flying to instrument rating standards, and at other times, performing badly on the entire flight. With more flight time, probably less than that required for a commercial, an instrument rating would be possible for the average student.

FI_4 I do not believe an "average" student can achieve an instrument rating in 80 hours. An above average student who is literally willing to "eat, sleep, and drink" what is being taught could indeed achieve an instrument rating; however, as I have pointed out before, even this type of student will have his short comings. A back-up of experience and exposure which would normally keep most instrument pilots out of trouble is simply NOT present in 80 hours; but, his ability to adapt to emergencies, amended clearances, and ATC procedures in general would tax his skill beyond its capability.

FI_5 No. For the average student to get a private now it takes between 50 and 60 hours. So this would mean an instrument rating in 20 more hours. I can't do this with a student and call him a safe instrument pilot, let alone pass the check ride.

4. Elaborate on how this type of integrated instrument program aids or detracts from student progress.

FI_1 I feel that it is possible to get too highly integrated in the initial stages, which detracts from the solo time utilized early in the program. The lack of command pilot time rears its head later in the form of the background necessary for rendering decisions when the student is operating in the system. Of course, the integrated program can be viewed either from the instrument pilot level or from the private pilot level. I tend to view the program not from the standpoint of developing a lower-time instrument pilot but from developing a well-rounded and sound private pilot. It is in this context that I feel the greater value can accrue to the instructional program in aviation. I firmly believe in developing a solid foundation in piloting skills early in the training and than this foundation in the long run will provide for the "superior" type of pilot we all strive to develop. I judge these students in the program not from their instrument skills as such at this level but from their knowledge of the system in which they operated. To me this is the true value of the program.

FI_2 The integrated program has produced a better private pilot in that he operates very well in the ATC System in a VFR capacity. His use of radio navigation aids is also better than the average private pilot.

FI_4 I believe the IFR-VFR program aids tremendously in producing a superior private pilot with a fundamental knowledge to gain further experience and judgment and to continue on toward advanced ratings. The program may tend to detract from the progress of students wishing only a private license because of the fact that their goal is not instrument proficiency, but private pilot "enjoyment" proficiency. If the student is not motivated toward instrument flying then his performance will not be good and his frustration in this area will carry over into his VFR work. Consequently, both motivation and aptitude have to play an important part in the success of this type of program.

FI_5 I feel the program, as such, produces a very adept and experienced PRIVATE PILOT. The student has worked in the system and knows more of what he has working for him and the facilities he can use. He knows how to use his equipment well. Some students tend to rely on the instruments for VFR work but with special attention and effort he can be kept from staring at the panel.

APPENDIX J

EXAMINERS' FLIGHT TEST NARRATIVES

Subject E 1

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/28/68	Dual:	62.0
Duration:	2 hours 10 minutes	Solo:	16.2
Weather:	VFR, Light Turbulence	Instrument:	28.8
Aircraft N No.:	N210SU	Solo X-C:	6.3
By:	R. T. Maynard, FS-446	Total:	78.2

PHASE I - ORAL

E 1 demonstrated a thorough and knowledgeable approach to planning and filing an instrument flight plan. He also responded well to questions of performance, range, required instruments, and equipment of the airplane. Performance on the oral test was satisfactory to the standards required for an instrument rating.

PHASE II - INSTRUMENT FLYING

A satisfactory achievement in all the skill requirements of this phase was demonstrated.

PHASE III - RADIO NAVIAGATION AND APPROACH PROCEDURES

The strength of the demonstrated skills of voice communications and knowledge of ATC procedures, compliance with ATC instructions, clearance copying, and radio orientation was not consistent with the performance in approaches, simulated emergencies, and missed approaches. The pilot missed the VOR on the initial approach to Zanesville and executed an improper missed approach (altitude) and failed to recognize a radio failure during an ILS approach to Columbus. His other performances are convincing that he is capable of much better performances in the unsatisfactory areas.

RESUME'

The performance in Phase III was not acceptable for an instrument rating. However, it is evident that only a few hours of instruction should be necessary to improve his performance to acceptable standards.

Subject E 3

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/27/68	Dual:	66.9
Duration:	2 hours 20 minutes	Solo:	10.9
Weather:	VFR, Light Turbulence	Instrument:	20.5
Aircraft N No.:	N210SU	Solo X-C	6.1
By:	R. T. Maynard, FS-446	Total:	77.8

PHASE I - ORAL

The trainee demonstrated satisfactory knowledge of flight planning, filing of flight plans, aircraft performance, range and fuel requirements, and the instruments installed in the airplane.

PHASE II - INSTRUMENT FLYING

The performance of the applicant in the maneuvers of straight and level, stalls, and maneuvering at approach speeds was acceptable. His demonstrated skills in climbing, descending, and turning maneuvers using needle, ball, and airspeed only, as well as steep turns and recovery from unusual attitudes of flight were substandard. He was unable to control the airspeed during recovery from unusual attitudes or climbs and descents. His attempts to maintain a constant bank attitude in steep turns or normal turns were unsuccessful.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

Compliance with ATC procedures, instructions, normal low approaches, and voice communications skills were acceptable performances. The radio orientation demonstration was also satisfactory. His failure to recognize or to deal effectively with simulated radio failures during approach operations revealed a lack of effective instruction in emergency procedures. He also demonstrated a discipline of using only primary equipment needed for the operation and did not use additional equipment as a back-up or support to the primary functions. Neither was a checklist procedure used during terminal operations.

RESUME

The overall performance of the subject was short of acceptability for an instrument rating. However, approximately 15 hours more of instruction may develop skills to a point of acceptability for these standards.

Subject E 3

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	5/22/68	Dual:	91.0
Duration:	1 hour 50 minutes	Solo:	17.1
Weather:	VFR, Light Turbulence	Instrument:	38.7
Aircraft N No.:	N180SU	Solo X-C:	6.1
By:	Fred F. Martin, EA-GADO-7	Total:	108.8

PHASE I - ORAL

Satisfactory.

PHASE II - INSTRUMENT FLYING

Satisfactory, with only minor errors noted.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

Applicant's performance in this phase was below the minimum standards for certification. The applicant used the wrong type of entry to holding pattern. He exceeded his clearance limit by continuing beyond the beacon prior to being issued an approach clearance at The Ohio State University Airport. On the ILS approach the applicant was above the glide path consistently and corrected pitch without a power reduction resulting in high airspeed.

RESUME'

The applicant would not have met the minimum standards for the instrument rating and it is believed that it would require a minimum of 2 to 4 hours additional preparation time for him to meet these minimums.

Subject E 4

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/11/68	Dual:	53.0
Duration:	1 hour 40 minutes	Solo:	18.3
Weather:	IFR	Instrument:	29.8
Aircraft N No.:	N180SU	Solo X-C:	6.8
By:	Fred F. Martin, EA-GADO-7	Total:	73.0

PHASE I - ORAL

The applicant was satisfactory on the oral and his knowledge of flight planning and aircraft performance was adequate.

PHASE II - INSTRUMENT FLYING

The applicant's coordination was weak and his aircraft control was minimum but he accomplished all flight test maneuvers requested in a manner that met the minimum standards.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

Applicant required major assistance from the check pilot in complying with his ATC clearances, and due to instrument conditions was not permitted to vary to any great extent. He was always behind the aircraft in his thinking process.

RESUME'

The applicant would not have met the minimum standards for an instrument rating due to lack of precision and in complying with ATC instructions. It is estimated that in excess of 15 additional hours of instruction would be necessary for the student to meet certification standards.

Subject E 5

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/37/68	Dual:	57.0
Duration:	2 hours, 20 minutes	Solo:	19.0
Weather:	VFR, Light to Moderate Turbulence	Instrument:	31.0
Aircraft N No.:	N180SU	Solo X-C:	6.5
By:	Fred F. Martin, EA-GADO-7	Total	76.2

PHASE I - ORAL

The applicant displayed adequate knowledge of instrument flight planning and preparing of flight log and filing of instrument flight plan. He was well versed on aircraft performance, range and fuel requirements, and the required instruments and equipment for IFR flights.

PHASE II - INSTRUMENT FLYING

Partial panel instrument flight was satisfactory except that in time turns the bank was shallow and roll out was initiated with insufficient heading changes. Stalls and maneuvering at approach speed were satisfactory. In executing steep turns excessive altitude was gained. His attitude interpretation and aircraft control in unusual attitude was satisfactory.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The applicant's performance in this phase was below the minimum standards. Applicant requested IFR clearance on wrong frequency. He either did not identify navigation facilities tuned to or was late doing so. He became so engrossed in controlling the aircraft that he ignored calls from ATC. He did not use a check list and the entire flight was conducted on one fuel tank. The enroute procedures were unsatisfactory. The applicant changed communications frequencies at his discretaion without clearing with the controlling facility. Use and knowledge of the transponder was inadequate in that when asked to speak, the applicant would identify. Holding pattern and holding pattern entries were also unsatisfactory. Use of ADF was satisfactory. ILS approach was below minimum standards and heading changes inside the outer marker were too large, one being 30°.

RESUME'

Applicant would not have met minimum standards for the instrument rating and he would have disrupted the Air Traffic System with his inadequacies. Wher the task of communications was introduced with the responsibility

of controlling the aircraft it taxed the student's capabilities. It is believed that the applicant would require approximately 10 to 15 additional hours of instrument instruction prior to his meeting present instrument standards for the rating.

Subject E 6

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/12/68	Dual:	56.8
Duration:	1 hour 25 minutes	Solo:	14.6
Weather:	VFR	Instrument:	26.7
Aircraft N No.:	N180SU	Solo X-C:	7.0
By:	Fred F. Martin, EA-GADO-7	Total:	71.4

PHASE I - ORAL

The applicant was satisfactory on the oral and his knowledge of flight planning and aircraft performance was adequate.

PHASE II - INSTRUMENT FLYING

The applicant's basic aircraft control was satisfactory and he accomplished all flight test maneuvers requested in a manner that met the minimum standards.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The applicant successfully completed all required maneuvers with no major errors in procedures or compliance with ATC instructions, except the ADF approach. On the ADF approach the student departed the beacon on the wrong bearing from the station and required radar vectors back to course.

RESUME

The applicant would not have met the minimum standards for an instrument rating due to the ADF approach. It is estimated that in approximately 5 additional hours of instruction the student may meet certification standards.

Subject E 7

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/10/68	Dual:	51.2
Duration:	1 hour 40 minutes	Solo:	20.4
Weather:	IFR	Instrument:	30.4
Aircraft N No.:	N180SU	Solo X-C:	6.7
By:	Fred F. Martin, EA-GADO-7	Total:	71.6

PHASE I - ORAL

The applicant was satisfactory on the oral and his knowledge of flight planning and aircraft performance was adequate.

PHASE II - INSTRUMENT FLYING

The applicant's coordination was weak and his aircraft control was rough but he accomplished all flight test maneuvers requested in a manner that met the minimum standards.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The applicant successfully completed all required maneuvers with no major errors in procedures or compliance with ATC instructions.

RESUME

The applicant would not have met the minimum standards for an instrument rating due to lack of precision. It is estimated that in approximately 5 additional hours of instruction the student may meet certification standards.

Subject E 9

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/4/68	Dual:	62.4
Duration:	1 hour 48 minutes	Solo:	24.4
Weather:	VFR, Light Turbulence	Instrument:	34.7
Aircraft N No.:	N180SU	Solo X-C:	11.9
By:	Fred F. Martin, EA-GADO-7	Total:	86.8

PHASE I - ORAL

The applicant displayed adequate knowledge of instrument flight planning, preparing flight log, and filing of instrument flight plan. He was well versed on aircraft performance, range and fuel requirements, and the required instruments and equipment for IFR flight.

PHASE II - INSTRUMENT FLYING

Applicant was satisfactory in his ability to control the aircraft in all individual flight maneuvers when not incorporated with other tasks.

PHASE III - RADIO NAVIGATION AID APPROACH PROCEDURES

In flying the VOR approach the student was erratic on pitch control and descended three hundred feet below minimum altitude inbound to the VOR and then made an adequate correction. After crossing the VOR inbound he made large heading changes and became engrossed with heading corrections that caused him to lose track of time and did not descend to MDA. Due to losing track of time the student flew seven miles beyond the airport prior to executing a missed approach. The applicant was unable to maneuver into the holding pattern. In executing the ADF approach the applicant tuned in the wrong facility (tuned Springfield, Ohio, Radio Beacon instead of OSU) and was unable to execute the approach.

RESUME

The applicant would not have met the minimum standards for the instrument rating. It is estimated that the applicant would require more than 15 additional hours of instrument instruction prior to meeting certification standards.

Subject E 11

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/27/68	Dual:	57.2
Duration:	1 hour 55 minutes	Solo:	20.4
Weather:	VFR, Light to Moderate Turbulence	Instrument:	30.9
Aircraft N No.:	N160SU	Solo X-C:	6.2
By:	Fred F. Martin, EA-GADO-7	Total:	77.6

PHASE I - ORAL

The applicant displayed adequate knowledge of instrument flight planning, preparing of flight log, and filing of instrument flight plan. He was well versed on aircraft performance, range and fuel requirements, and the required instruments and equipment for IFR flights.

PHASE II - INSTRUMENT FLYING

Partial panel flight, stalls, and maneuvering at approach speeds were satisfactory. Steep turns and unusual attitude recoveries were also satisfactory. The applicant obtained a check list for the aircraft prior to flight but was unaccustomed to using it, and it became a handicap to him in attempting to use it in flight.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The applicant's performance in this phase was satisfactory and was accomplished with only minor errors noted.

RESUME

The applicant was considered to have met the minimum standards of proficiency for the issuance of an instrument rating.

Subject E 12

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/28/68	Dual:	48.2
Duration:	1 hour 30 minutes	Solo:	22.2
Weather:	VFR, Light to Moderate Turbulence	Instrument:	20 .)
Aircraft N No.:	N180SU	Solo X-C:	7.1
By:	Fred F. Martin, EA-GADO-7	Total:	70.4

PHASE - ORAL

The applicant displayed adequate knowledge of instrument flight planning, preparing of flight, and filing of instrument flight plan. He was well versed on aircraft performance, range and fuel requirements, and the re required instruments and equipment for IFR flight.

PHASE II - INSTRUMENT FLYING

Applicant did not use a check list and ran battery down trying to start engine with mixture lean. Transponder was not turned until enroute operation and requested by Center Controller. The applicant's performance was below minimum standards for certification. On partial panel flying the applicant's pitch control was erratic, bank was not consistent and timing inaccurate, causing roll out on headings to be late. In steep turns applicant lost excessive altitude. Stalls and maneuvering at approach speed were satisfactory. Recoveries from unusual attitudes were satisfactory.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The applicant's performance in this phase was below minimum standards for certification. Due to over concentration on aircraft control the applicant ignored calls from Center. He became lost while executing a VOR approach after departing the holding pattern. Check list was not used and errors of omission were committed. On the ILS approach the applicant was over-controlling heading changes and pitch changes. The ADF approach was satisfactory; however, the rate of descent on final approach was excessive in getting down to minimums.

RESUME

The applicant would not have met the minimum standards for the instrument rating. It is estimated that the applicant would require 10 to 15 additional hours of instrument instruction prior to meeting certification standards.

Subject E 12 (Retest)

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	5/22/68	Dual:	59.4
Duration:	1 hour 50 minutes	Solo:	30.0
Weather:	VFR, Smooth Air	Instrument:	32.0
Aircraft N No.:	N180SU	Solo X-C:	7.1
By:	Fred F. Martin, EA-GADO-7	Total	90.2

PHASE I - ORAL

Satisfactory.

PHASE II - INSTRUMENT FLYING

Satisfactory, with minor errors noted.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURE

The applicant's performance in this phase was below the minimum standards for certification. The applicant omitted one compulsory call to ATC on a VOR approach. He did not descend to published minimums on the VOR approach because he did not read the approach plate correctly. The applicant used the wrong type of entry to a holding pattern. When given a minor emergency (the loss of the directional gyro) while in a descent from 3000' to 2700' the applicant's cross check was effected and he neglected pitch control to a point that a climb was initiated to 3400'.

RESUME

The applicant would not have met the minimum standards for the instrument rating and it is believed that it would require a minimum of 2 to 5 hours additional preparation time for him to meet these minimums.

Subject E 14

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/3/68	Dual:	55.3
Duration:	1 hour 55 minutes	Solo:	17.6
Weather:	VFR, Smooth Air	Instrument:	35.0
Aircraft N No.:	N210SU	Solo X-C:	7.9
By:	Fred F. Martin, EA-GADO-7	Total:	72.9

PHASE I - ORAL

The applicant displayed adequate knowledge of instrument flight planning, preparation of flight log, and filing of instrument flight plan. The applicant was well versed on aircraft performance, and range and fuel requirements. He was weak in the area of air traffic rules.

PHASE II - INSTRUMENT FLYING

Applicant was satisfactory and met minimum standards as far as aircraft control was concerned when flying basic instruments without the burden of ATC clearances, etc.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

On departure from OSU airport the student remained on the tower frequency (121.1) and had been instructed to maintain runway heading and contact departure control on 123.8. After some delay and much confusion the student inquired of the undersigned inspector as to why he was not being radio vectored. The directional gyro was 20° off the magnetic compass. On the VOR approach the applicant exceeded his clearance limit because of a combination of errors (lack of consideration of drift, less than standard rate turns, lost track of time) resulting in a conflict of traffic. A delay in setting up radios resulted in not receiving an intersection on final approach course. Pitch control on final approach was erratic. Applicant unable to tune ADF properly (on wrong frequency band). After missed approach the applicant became disoriented.

RESUME

The applicant would not have met the minimum standards for the instrument rating. It is estimated that the applicant would require in excess of 15 additional hours of instrument training prior to meeting minimum standards for certification.

Subject E 15

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	3/27/68	Dual:	51.4
Duration:	2 hours	Solo:	19.3
Weather:	VFR, Light Turbulence	Instrument:	16.0
Aircraft N No.:	N210SU	Solo X-C:	6.7
By:	R. T. Maynard, FS-446	Total:	70.7

PHASE I - ORAL

The subject demonstrated a satisfactory knowledge of the airplane performance, and range and fuel requirements. His response to questions about the instruments and equipment were also acceptable. However, he failed to demonstrate that he could satisfactorily plan an operational flight with respect to obtaining the necessary weather forecasts or an appropriate flight log, although he was alloted 80 minutes for flight preparation.

PHASE II - INSTRUMENT FLYING

The performance of the trainee in recovery from unusual flight attitudes using needle, ball, and airspeed only was satisfactory. None of the remaining maneuvers of this phase of the test were acceptable, however. The basic skills involved in maintaining headings, altitudes, bank attitudes, and the planning for the maneuvers were all substandard.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

The performance of the subject in voice communications, radio orientation, approaches, emergencies, or compliance with ATC instructions was not acceptable. He did not utilize all the navigation and approach equipment available to him. He also failed to recognize the simulated failure of radio equipment and take appropriate action when the failures were obvious. No check list procedure for terminal operations was demonstrated and an initial turn in the wrong direction was made on entering a holding pattern.

RESUME

The trainee's performance on this test indicates that more than 15 hours of further instrument instruction may be necessary to develop his skills to the standards for an instrument rating.

Subject E 16

FLIGHT CHECKED		FLIGHT TIME HISTORY	
Date:	6/4/68	Dual:	57.7
Duration:	2 hours	Solo:	17.1
Weather:	VFR, Calm	Instrument:	33.1
Aircraft N No.:	N180SU	Solo X-C:	6.7
By:	Fred F. Martin, EA-GADO-7	Total:	74.8

PHASE I - ORAL

The applicant displayed adequate knowledge of instrument flight planning and preparing of flight log and filing of instrument flight plan. He was well versed on aircraft performance, range and fuel requirements, and the required instruments and equipment for IFR flight.

PHASE II - INSTRUMENT FLYING

Applicant displayed satisfactory ability to control the aircraft in all individual flight maneuvers when not incorporated with simultaneous tasks requiring use of radio and voice procedures. In steep turns however his pitch and bank control was erratic.

PHASE III - RADIO NAVIGATION AND APPROACH PROCEDURES

Applicant became confused and used unsatisfactory techniques in transitioning from enroute to the approach segment on the VOR approach. He did not comply with the missed approach instructions issued (intercepted VOR radial and turned outbound from the facility he had been cleared to). Applicant was issued holding instructions and was 20 miles from the holding fix when he initiated the holding pattern entry. The applicant on several occasions transmitted on the wrong frequency during the flight. Many errors of omission were committed during the flight (failure to accomplish required check list items, fuel management, etc.).

RESUME

The applicant would not have met the minimum standards for the instrument rating. It is estimated that the applicant would require more than 15 additional hours of instrument instruction prior to meeting certification standards.